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VICTORIA · · · AUSTRALIA

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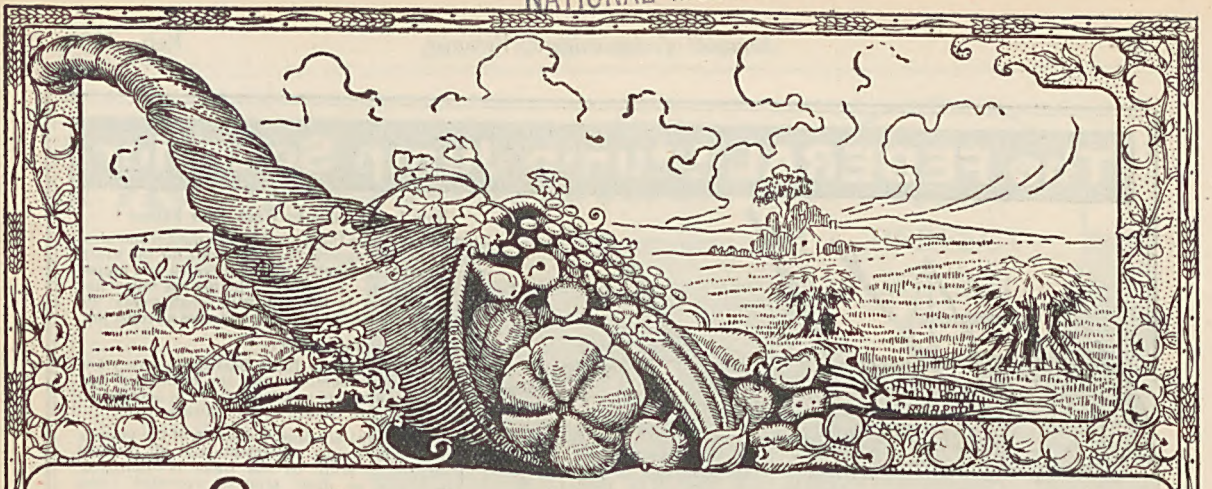

Contents.

FEBRUARY, 1938

	PAGE
Phillip Island Farm Competition, 1936–37 *J. E. Harrison, B.Agr.Sc. and D. R. McKenzie*	53
Irrigated Pastures—Influence of Grazing *E. T. Beruldsen, B.Sc. (Agric.) and A. Morgan, B.Agr.Sc.*	60
Grooming the Horse	67
Nut Culture and Production in Victoria (The Walnut) *E. E. Pescott, F.L.S.*	68
Millewa Crop and Fallow Competition, 1937 *H. L. Hore, B.Agr.Sc.*	76
Wheat Trials in the Goulburn Valley—Tests at Invergordon	79
London Markets	81
Butter Production and Export	82
Tubercle Free Herds	82
Orchard and Garden *J. L. Provan, B.Agr.Sc. and A. W. Jessep, M.Agr.Sc., B.Sc., Dip. Ed.*	83
Viticultural Notes *D. G. Quinn*	86
Fertilizers Act—Prosecution for Offence	87
Efficiency of Pasteurization *R. N. Trembath, B.Agr.Sc. and F. S. J. Newman, B.Agr.Sc.*	88
Investigations on the Storage, Ripening and Respiration of Pears—Part II. *G. B. Tindale, B.Agr.Sc., S. A. Trout, M.Sc., Ph.D., and F. E. Huelin, B.Sc., Ph.D.*	90
Inspection of Fruit for Export	104
Deal Lightly with the Lamb	104

Issued by direction of the Hon. E. J. Hogan, M.L.A., Minister of Agriculture.

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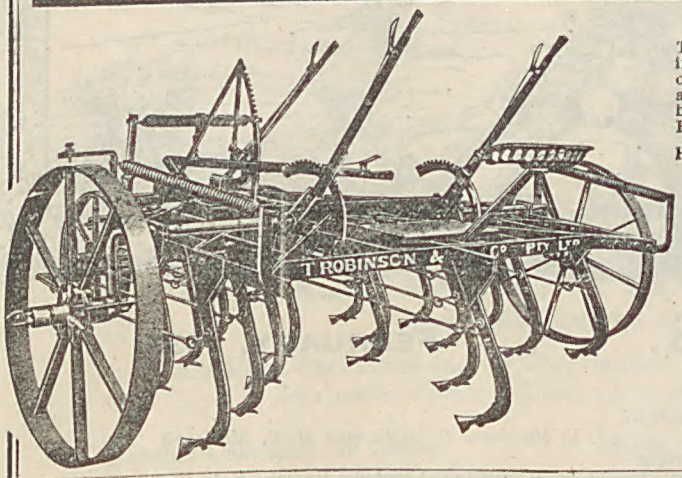

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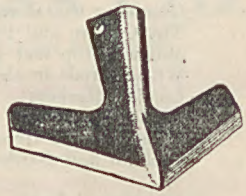

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INDEX TO ADVERTISEMENTS

FRONT SECTION

Commonwealth Serum Laboratories ... vi

Gerrard Wire Tying Machines Co. Pty. Ltd. .. .. opp. p. 73

Gippsland and Northern Co-operative Coy. Ltd. (Seeds) ... ... opp. p. 63

Goodyear Tyres ... ... opp. p. 62

Hardie, James & Co. Pty. Ltd. iv

International Harvester Coy. of Australia Pty. Ltd. (Tractors and Implements) ... v

Leggo, Victor, & Farmers Ltd. ... inside cover

Lysaght Bros. & Coy. Pty. Ltd. ... opp. p. 73

McKay Massey Harris Pty. Ltd. iii

Robinson, T. & Coy. Pty. Ltd. ii

Vacuum Oil Coy. Ltd. ... ... opp. p. 72

Wills, W. D. & H. O. (Aust.) Ltd. ... (Right Angle Tobacco) ... iv

BACK SECTION

Australian Cement Ltd. ... ... inside cover

Bayer Pharma Ltd., Sydney (Ceresan) opp. p. 95

Blyth Chemicals Ltd. viii

Cockbill, J. vii

Commonwealth Fertilisers and Chemicals Ltd. (Smutol, &c.) vii

Dunlop-Perdriau Rubber Co. Ltd. ... opp. p. 94

Elder Smith & Co. Ltd. (Esa Bluestone) vii

Lane's Motors Pty. Ltd. (Tractors) outside cover

Law Somner Pty. Ltd. ... ... opp. p. 84

Paspalum Seed for Sale xii

McGregor Wheel Grip and Engineering Pty. Ltd. ... ... opp. p. 85

Friesian Bull Calves for Sale xi

Red Poll Bull Calves for Sale ix

Rylands Bros. (Aust.) Ltd. viii

State Savings Bank xii

Stud Breeders' Cards x

Trewhella Bros. Pty. Ltd. xii

Victorian Railways x

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16-row	.. 33-tyne	..	cultivates 9½-ft.
20-row	.. 41-tyne	..	cultivates 12-ft.
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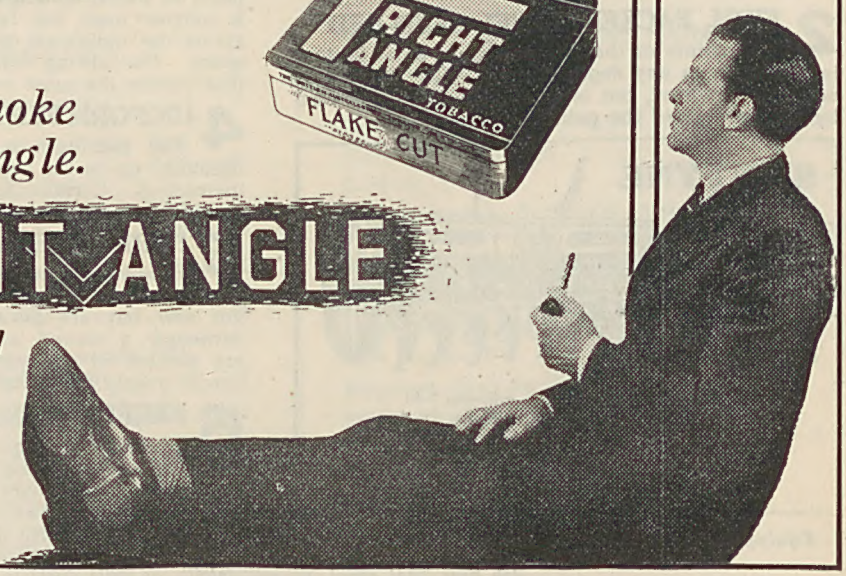

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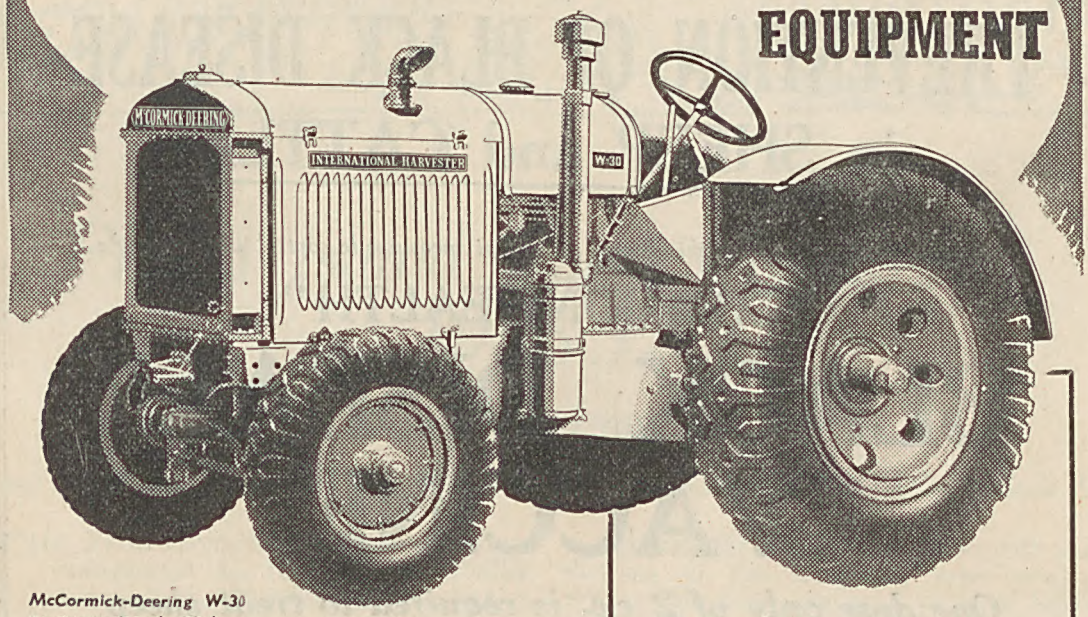

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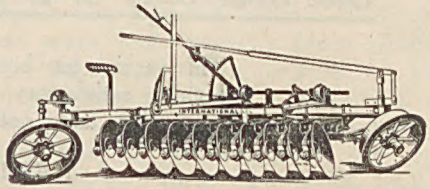

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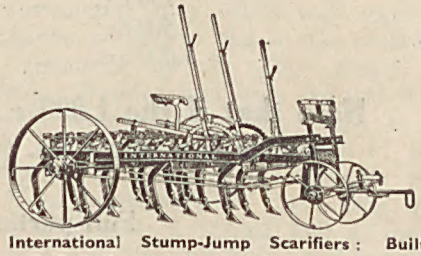

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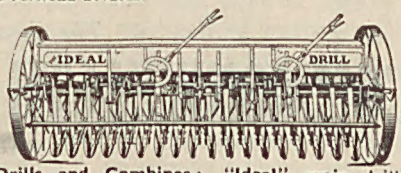

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The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Phillip Island Farm Competition 1936-37

A Record of Improvement

Report of the Judges, J. E. Harrison, B.Agr.Sc. (Pastures and Fodder Crops) and D. R. McKenzie (Stock, &c.)

THE Farm Improvement Competition was inaugurated in 1933 by the Phillip Island Better Farming League, and is based on the improvements made on competing farms for the twelve months ended November in each succeeding year. Though pastures and stock are made the principal sections of the competition, points are awarded also for improvements in clearing, fencing, drainage, water supply, buildings, and machinery.

Interest has been keenly maintained since the competition began in 1933. Definite lines of improvement were adopted in the beginning and have been adhered to since, with the usual benefits that arise from a continuous and sustained policy of progress. Each farm has been treated as an individual unit, and the planned programme of improvement, especially in regard to pastures and stock, which was laid down in the beginning, has been followed since.

The progress made has been extraordinary, and many properties have been raised, within the period of the competition, from a condition of unimprovement to an advanced point of development. Without exception, farmers have worked hard and enthusiastically for the improvement of their properties, and have reached a position where they may confidently expect to reap the reward of systematic industry.

Although the island, in common with many districts of the mainland, experienced an unfavorable year, improved pastures behaved well under the stress of heavier stocking than in past years, and on many farms production per cow was greater than previously. For the last five years, since the competition began, farmers have been steadily laying down more of their land to better pasture species, and have developed these new fields, and have greatly improved many natural pastures, by regular autumn applications of superphosphate.

At the begining of the year, most farmers were fortunately in a fairly well consolidated position to withstand the stress placed upon their resources by the poor season which followed. Fodder had been conserved on an ample scale previously, and came in useful during the year when the growth of pastures was light; and, in spite of adverse weather, the better species, with their long growing period, ultimately produced well as the season advanced, and kept stock in good heart.

In addition to the favorable development of pastures, there has been a steady yearly increase in the quality and number of animals in herds and flocks. Though mature animals have necessarily been bought in, most farmers have adopted the better policy of breeding their own stock by using selected sires on their own females, and to-day there are groups of

Raking grass hay on Mr. V. Justice's property.

attractive and uniform young stock coming on or ready to take their places in the herds and flocks of their owners. Both selected bulls and rams (many of the former obtained through the Government bull purchase scheme) have been bought, and farmers and graziers are steadily winning their way towards independence of outside sources in the maintenance and increase of their stock numbers.

It was fortunate that in the past few years pastures had developed ahead of the requirements of stock on most farms, and that opportunity had presented itself for conserving fodder on a satisfactory scale. At the end of 1936, after three or four years' top-dressing of both sown pasture and natural pasture, it was apparent that many farms could carry more stock, which were therefore obtained and were satisfactorily carried throughout the year. At the same time the experience confirms the policy often expressed by experienced farmers —that when pasture improvement is undertaken, it is wise to let the pastures get well ahead of the stock on hand, and to bui'd up fodder reserves, before the numbers of sheep or cattle are increased.

In spite of the demonstrated value of fodder reserves, it is necessary to emphasize again the necessity for conserving fodder regularly. If a farmer has carried his stock satisfactorily, without recourse to all his reserves, it is better to regard it as a single favorable occurrence and not as evidence that the need of fodder reserves is not as great as thought.

Conditions for the growth of pastures in winter are as variable as for any other season of the year, and one favorable winter is no measure of what the next winter might be. It is beyond question that, over a period of years, ample reserves of fodder are necessary for the maintenance of good health and regular profitable production in stock. Regular conservation of fodder offers the only sound security when lean times come.

Increases in the stock-carrying capacity of the farms are worth special comment. Mr. V. Justice is carrying the equivalent of one cow to less than 2 acres, while Mr. Jeffery, who originally carried one sheep to the acre without fattening any lambs, is to-day carrying three sheep to the acre. Mr. J. Roberts has a highly-improved 80-acre farm, well subdivided, and is carrying four sheep to the acre. Mr. Roberts actually sold over 1 ton of wool, besides fat sheep and lambs, during the year. Only five years ago Mr. J. Graydon had eighteen cows, but now is milking 40. In addition, he has twelve yearling heifers, two bulls, twenty poddy calves, and five horses on his 128-acre farm. Similar increases are to be found on many farms on the island.

The Awards.

Mr. V. Justice secured first place with an aggregate of 23 points for improvements during the year. The work done was distributed over six of the thirteen sections of the competition. This property is very highly developed, consisting of 92 acres, well

A hay sweep attached to a tractor on the property of Mr. R. G. Jeffery.

Portion of Mr. R. G. Jeffery's Ayrshire herd.

subdivided into eleven paddocks abutting on to a lane-way for convenient working. Good fences and swinging gates have been erected. Splendid plantations and hedges have been provided as shelter for the stock. Provision has also been made for a good water supply, sufficient being available for stock and domestic uses.

Although the dairy cows are generally a mixed breed, they have proved their worth in returns, as, with six additional cows, they show an increase of over 100 lb. butter-fat per cow in the Peninsula Herd Testing Association for the year ended 30th June last. Mr. Justice has a fancy for Jerseys, and during the year purchased through the Government bull purchase scheme an excellent type and production young bull from the "Eulomo Jersey Stud" out of a 467-lb. butter-fat Standard Test cow. There are also four pure female Jerseys on this farm.

This excellently-managed farm is carrying the equivalent of one dairy cow to 2 acres. A good cowshed and a concrete dairy are other features. The home is neatly kept, surrounded by nice fruit, flower, and vegetable gardens. Thoroughness is the principle upon which this progressive farmer works.

Mr. R. G. Jeffery, who was equal third last year, has improved his position by gaining second place, his improvements covering ten of the sections, with a total gain of sixteen points. In the stock section he has added 50 stud Border Leicester ewes to his stud. In the fencing section 100 chains of Cyclone fencing has been erected by Mr. Jeffery's son.

The plantations have again received attention on this well-managed farm, 21 chains of Cupressus Lambertiana having been planted in addition to 1 square chain of redgums, while a new twelve-bail cowshed has been erected. So well is the reserved fodder conserved on this farm that 16 tons of pressed meadow hay and 12 tons of stacked meadow hay were on hand after all stock had been fed during the winter. A new 1,500-yard dam has also been excavated.

Third place was awarded to Mr. W. H. Mallory with a gain of twelve points. Mr. Mallory was first in the competition in 1934. A general all-round improvement was apparent here also, and much hard work had been put into this attractive farm.

Other entrants have achieved merit in several sections—Mr. J. W. Gliddon for improvement in stock, and Mr. K. Sambell for improvement in several sections, particularly in those for clearing and young stock. Mr. McLardy and Mr. K. McIlwraith scored well in some of the sections, while Mr. Parry did well with fencing and plantations.

The Better Farming League deserves great credit for its enterprise and enthusiasm. The competitors also are to be congratulated upon entering wholeheartedly into the competition and on the improvements which they have carried out on their respective farms. A word of praise is also due to the secretary of the League, Mr. E. R. Marchment, for the amount of work done in the competition.

Stock.

The general standard of the stock has shown improvement during the past four years, but there is still room for progress, particularly in the quality of the dairy herds. Definite improvement is to be seen in the young stock this year, the advancement being due unquestionably to the use of better sires. One of the pleasing features in this competition is that all the dairy farmer competitors are now using pure-bred sires in their herds. There is no more interesting work in the whole range of farming than stock breeding, and much added pleasure is certainly derived from developing and improving the quality of the stock, while the profits are being increased at the same time. Outstanding improvement is shown in butter-fat returns during the year.

Messrs. N. McLardy and V. Justice had an increase of over 100 lb. of butter-fat per cow, while Messrs. Gliddon and K. Sambell had over 50 lb. per cow increase in the Peninsula Herd Testing Association for the year ended 30th June last. All of these entrants had more cows than in the previous year.

The development and management of grassland, with suitable subdivision into smaller paddocks, have contributed greatly to the increased butter-fat yields, and considerably reduced the overhead costs. The grading up of the herd on its production must always be maintained by testing the yields of each cow regularly and disposing of those cows which are unprofitable.

Pigs.—The pig section is showing more improvement than hitherto. It is worth while remembering that, on a well-managed farm, 20 per cent. of the value of cream is commonly obtained from pigs.

Sheep.—The flocks continue to show improvement. Mr. R. G. Jeffery added 50 Border Leicester ewes to his stud during the

A type and production bull bought through the Government Bull Purchase scheme by Mr. V. Justice.

INCREASES IN POINTS AWARDED FOR THE TWELVE MONTHS ENDED NOVEMBER, 1937.

Name.	Pasture.	Crops and Fodders.	Stock.				New Plantations.	Clearing.	Fencing.	Drainage.	Water Supply.	Buildings, Additions and Renovations.	Machinery.	Total.		
			Male.	Females.	Young Stock.	Uniformity Health Appearance.								Stock, &c.	Pasture, &c.	Total.
V. Justice ..	15	3	2	1	..	..	..	..	1	..	1	..	..	5	18	23
R. G. Jeffery ..	7	..	1	2	1	..	1	..	1	..	1	1	1	9	7	16
W. A. Mallory ..	5	2	2	..	..	..	1	1	1	..	..	..	..	5	7	12
J. W. Gliddon ..	5	..	2	..	..	..	..	1	1	..	..	..	..	4	5	9
J. Roberts ..	3	5	..	..	..	..	..	1	..	..	..	..	..	1	8	9
K. Sambell ..	5	−3	1	..	1	1	..	2	1	..	..	..	..	6	2	8
L. R. Dixon ..	5	..	..	1	1	..	..	..	1	..	..	..	..	3	5	8
K. McIlwraith ..	3	..	..	..	..	..	..	1	2	..	..	1	1	5	3	8
N. McLardy ..	5	−4	..	1	1	1	..	1	..	..	1	1	..	6	1	7
H. W. Parry ..	2	..	..	..	..	..	3	..	2	..	..	..	..	5	2	7
W. B. Dixon ..	3	..	..	1	1	1	..	..	1	..	..	..	..	4	3	7
A. E. West ..	4	..	..	1	..	..	..	1	..	..	..	..	..	2	4	6
J. B. Graydon ..	2	−2	..	1	..	..	1	..	1	..	..	..	1	4	..	4
H. Justice ..	2	−3	−2	2	1	..	..	..	..	..	..	..	1	2	−1	1

year, and some excellent export lambs were raised on Mr. Mallory's farm. The principle of the "better sire" is now recognized, and rapid improvement is taking place.

Horses.—The horse section is a really good one and up to the standard of the mainland. Some attractive foals were inspected at Messrs. L. R. and W. B. Dixon's.

The most notable feature in the live-stock section was the comparative uniformity of the young stock. Undoubtedly this is due to the use of better sires. Definite improvement in stock breeding can be obtained only by the use of pure-bred sires which have been selected with the utmost care as to the desired combination of breed type with dairy qualities,

A sugar gum plantation on the property of Mr. V. Justice.

Permanent Improvements.

More plantations are still required to shelter the stock from the cold bleak winds that prevail on the island. Mr. Parry (a new entrant) has planted out a row of cypresses 40 chains in length, while Mr. Jeffery has 21 chains of Cupressus Lambertiana and 1 square chain of red gums planted. Mr. Mallory has planted 15 chains of sheoaks and Mr. Graydon 11 chains of sugar gums.

Attention is again directed to the excellent shelter provided by ti-tree. It is a native of the island, easily grown, and its cultivation inexpensive compared with cypress or gums.

Considerable clearing has been done, but more attention should be given to the cutting of gorse, sword grass, rushes, and bracken fern. Seventy-five acres of gorse and ti-tree have been cleared during the year by Mr. K. Sambell, while Mr. K. McIlwraith (a newcomer to the competition) has done good work in the clearing of scrub.

Border Leicester ewes owned by Mr. R. G. Jeffery.

Many new fences are to be seen, and subdivision has received attention. Good fences are a sound investment. Some inferior fences and patchwork repairs are still to be seen. Many gates could be improved, too. On some farms the "Mallee gates" are in use. Besides being unsightly, these require much time to fasten and unfasten, and are a danger to stock.

The new fencing on Mr. Jeffery's farm has been previously referred to. Mr. Mallory has 55 chains of new fencing, Mr. Parry 70 chains, Mr. V. Justice 40 chains, and Messrs. J. Graydon and L. R. Dixon 20 chains respectively. A well-fenced farm under good repair, with gates swinging easily on their hinges, tells more than words the owner's methods and wisdom.

Meadow hay reserves—Mr. V. Justice.

Owing to the dry autumn and winter, very little has been done with regard to drainage.

Water supply has again received attention. On several farms it has been increased by enlarging old dams or sinking new ones. However, with so much subdivision taking place on many farms, water is not always so convenient for stock as is desirable, and it will pay to extend it to all new paddocks. A satisfactory means of controlling the water supply is a windmill, piping, and troughs, by means of which water can be made available at all times in each paddock. Stock should not be allowed to wade where they will foul the water, as this is almost certain to affect the keeping quality of the milk and cream. Mr. Jeffery's 1,500-yard dam has already been referred to. Mr. V. Justice has put in a silt and rubbish catchment to prevent manure, &c., flowing into his dam. Mr. N. McLardy has had water laid on to his fowl-pens.

Generally, the machinery is in good repair and on most farms is kept under cover. Milking machines have been installed by Mr. H. Justice, engine and saw bench by Mr. K. McIlwraith, and shearing plant by Mr. Gliddon.

There are two additional entrants this year —Mr. H. W. Parry and Mr. K. McIlwraith— and the improvements effected by these competitors in their first year have been excellent.

PASTURES AND CROPS.

In all young pastures, one and two years old, a general improvement was indicated by the increased clover content and greater density of the sward. Every sown pasture on all farms in the competition has been top-dressed annually since its establishment, with very satisfactory results in strengthening the sward and increasing herbage.

Regular manuring has been adopted as a practice by competition farmers, and results are very much in their favour. In the last year, also, manurial treatment of natural pastures previously top-dressed was maintained, and several new areas were treated for the first time. Some excellent results have been obtained at low cost by this means, but treatment has been restricted to those natural pastures which contained a nucleus of subterranean clover. On the properties of Mr. Sambell and Mr. Jeffery in particular, this method has led to rapid improvement on large areas, while on several smaller properties, such as those of Messrs. Gliddon, V. Justice, H. Justice, Graydon, Roberts, and West, very satisfactory results have been obtained. A few instances were seen where natural pasture containing no subterranean clover had been top-dressed, and in these cases either no response had been obtained or small clovers like suckling clover had been stimulated.

A very good new pasture, sown with a cover crop of oats, was seen on Mr. L. R. Dixon's farm. Perennial rye, cocksfoot, and subterranean clover had been sown and had struck well, and, though the grasses were not well grown, the clover had done very well, and in some places was dense in the base of the crop. This is an excellent result in the first year, and is no doubt largely due to the thorough methods of cultivation practised by Mr. Dixon.

Mr. R. G. Jeffery had new pasture, sown with 40 lb. of perennial rye, on land which contained much subterranean clover naturally.

Pressing grass hay on Mr. R. G. Jeffery's property.

Owing to a dry season and heavy grazing, a poor result was obtained, and, though rye-grass plants were numerous, they were spindly and were densely interspersed with silver grass, and only a few clover plants were present. Attention is again drawn to the fact that 10 lb. of perennial rye-grass seed per acre has been proved sufficient for its establishment on the island, and that satisfactory results are being obtained with sowings of 5 lb. per acre.

Mr. Mallory had new pastures to show, which had been grazed with sheep during the winter, and, though the strike had been good, growth had been poor. A better result had been obtained by Mr. McIlwraith, who had grazed his new pasture with cattle only, and had secured a better development of clover. Mr. Gliddon had sown subterranean clover with oats, with a fair result only, as, although the land had been worked sufficiently well for oats, it appeared too rough for clover establishment. The better growth and spread of the clover in the absence of grazing was, nevertheless, evident.

On a number of farms there are now well-established pastures which compare favorably with those in similar districts on the mainland. These pastures had performed excellently during the season, especially in those cases where superphosphate had been applied at the more liberal rate of one bag per acre. It has often been observed, both in practice and experiment, that liberal manuring has the most beneficial result in an unfavorable season, and there was suggestive evidence that this was the case on the island last year.

The excellence of the pasture growth on Mr. V. Justice's farm, where the equivalent of one cow to less than 2 acres had been carried throughout the year, was quite unexpected in view of the season. Mr. Justice had used 5½ tons of superphosphate on 85 acres of pasture, and this liberal dressing seemed mainly responsible for the better growth that occurred on other pastures of otherwise equal merit.

Conditions had not been favorable for cultivation and cropping, and less oats were sown than usual and crops were lighter. With the establishment of pasture, there is not the same need as formerly for oat crops; but, on much poor land where subterranean clover has not spread voluntarily, cultivation and the sowing down of oats as a cover crop to grasses and clovers remains the safest method of improvement on the island. Many fields had been sown to millet, a useful crop during summer months when both milk and fat lambs are required for the tourist trade, and, as grass and clover seeds may be sown on the millet stubble in the autumn, the crop paves the way for further pasture improvement also.

In general, crops of meadow hay were light, but most farmers were making an effort to harvest as much as possible. Of outstanding merit were the fields on the farm of Mr. V. Justice, who had closed 30 acres, or a third of his total area, for cutting as meadow hay. It is an example that all could follow on small farms.

Irrigated Pastures

Influence of Grazing

By E. T. Beruldsen B.Sc. (Agric.) Senior Irrigation Officer, and A. Morgan B.Agr.Sc. Irrigation Field Officer.

(The following report is complementary to one which was published in the Journal of the Department of Agriculture, Victoria, September, 1934.)

IN recent years much attention has been directed towards grazing management and it is widely recognized that variations in the method of stocking a pasture can effect as striking changes in the production and composition of that pasture as can variations in cultural practices. This is marked in the case of irrigated pastures, and, as it is well known that the use of good pasture species, good watering methods, and good manurial practice can build up highly productive pastures in the irrigation areas, it is important also to ensure that this high production is taken fullest advantage of by an intelligent regulation of the stocking, an important factor being the avoidance of waste. Again, avoidance of waste must not be secured at the expense of the pasture, as over-grazing can cause serious deterioration of a sward.

A study of the differential grazing habits of horses, cows, and sheep appears to be a valuable addendum to general investigations on rotational grazing methods, which involve arbitrary means of forcing stock to eat herbage. Information acquired in such investigations will prove of great benefit in the maintenance of satisfactory botanical composition and uniformity of growth in pastures.

While it is assumed generally that horses are the most, and cattle the least, fastidious grazing animals, and that sheep generally prefer fairly short feed, opportunities to measure the relative amounts of waste occurring through the varying grazing habits of these different animals rarely occur. At the State Research Farm, Werribee, the fact that certain pastures have been grazed almost exclusively by one or another type of stock provides opportunity for studies of this nature.

The main questions to be considered are—

(1) How much of the pasture is grazed effectively?

(2) Are the effectively-grazed areas permanent in location, or do the patches, over a comparatively short period, alternate between being neglected and being grazed short?

(3) What are the relative merits of horses, cattle, and sheep in the economic utilization of pasture?

Method.

As previously reported, a sufficiently accurate method was evolved to chart representative areas of the various pasture types. A wire mesh 1 chain long composed of sections 5 links square was used. (See Fig. 1.) Pegs were used to mark off permanent sites in each pasture. On account of the relatively large areas of short and long herbage in the horse paddock it was considered that the smallest area which could be regarded as truly representative of the whole was 1 acre, but in the case of the cow paddock the relatively small patches of short and long herbage were so closely intermingled that it was considered sufficient to chart an area of 1 square chain. Further, in the case of the horse

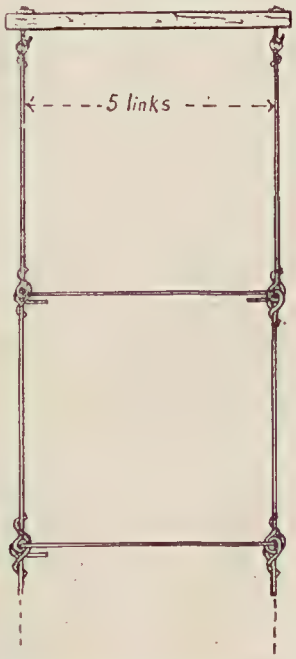


Fig. 1—Wire mesh used in charting.

paddock the work of charting was shared by two observers, each observer charting the same half of the area at each survey, while in the cow pasture one observer did the whole of the actual charting while the other made an estimation by eye of the relative amounts of heavily grazed, moderately grazed, and neglected herbage, a separate estimation being recorded for each 25 square links unit of the mesh.

Horse-grazed Pasture.

In the previous report on the investigations conducted in the horse paddock it was stated that the observations were for one year only, and that it was intended to continue the charting at intervals of one year to determine whether the aspect of the pasture would undergo a complete change over a period of years.

The conclusions reached as the result of charting for one year were that, in a pasture entirely grazed by horses, up to over 50 per cent. of the herbage could be neglected at any one time, and that never more than 50 per cent. was effectively grazed. It was found that the position of the neglected patches did not alter materially in relation to the position of the short patches over a period of one year, and that the botanical composition of the neglected patches was dominantly grassy. Further, the rank or neglected patches had an unpleasant odour emanating from them, the fact that all the animal droppings were concentrated in these patches aggravating the trouble.

The last survey recorded in the previous report was carried out in April, 1934. No further survey was done till July, 1935. A comparison of these two surveys is shown in Fig. 2. It will be seen that the position of the heavily-grazed patches in relation to the patches of neglected herbage has not altered to any great extent.

The percentage amounts of heavily grazed, moderately grazed, and lightly grazed or neglected herbage for all surveys are shown in Table I.

TABLE 1. — PERCENTAGES OF HEAVILY, MODERATELY, OR LIGHTLY GRAZED HERBAGE AT EACH SURVEY IN HORSE PADDOCK.

Date of Survey.	Percentage of Area Judged as—		
	(*a*) Heavily Grazed.	(*b*) Moderately Grazed.	(*c*) Lightly Grazed or Neglected.
	%	%	%
6 to 8.4.33 ..	34·7	8·2	57·1
18 „ 19.7.33 ..	40·1	7·4	52·5
12 „ 18.10.33 ..	39·5	37·0	23·5
22 „ 30.1.34 ..	46·7	20·2	33·1
24 „ 27.4.34 ..	44·3	12·2	43·5
8 „ 13.7.35 ..	47·3	13·9	38·8

In the winter of 1936 the horse paddock was grazed heavily by sheep for the first time.

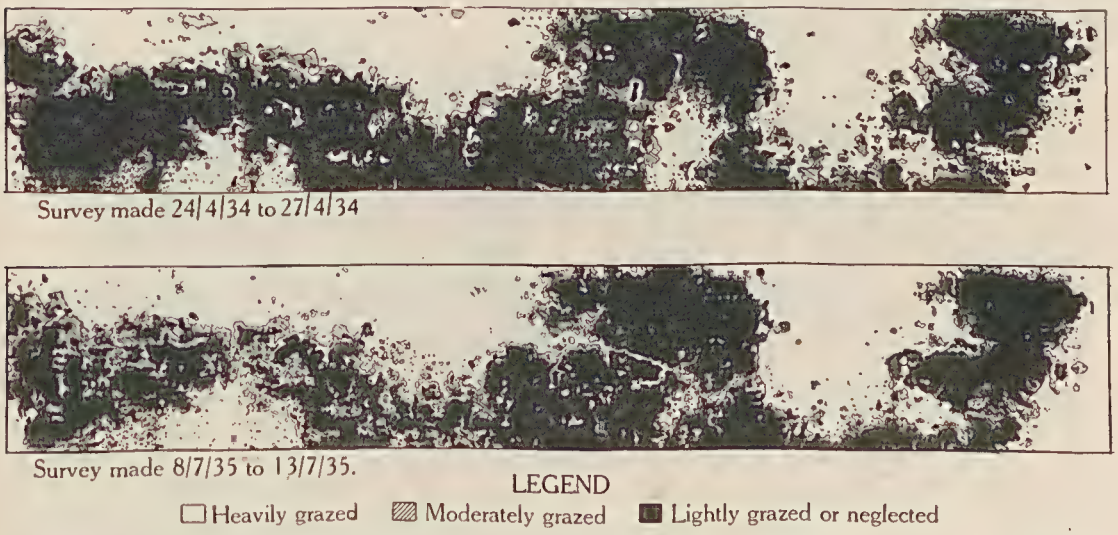
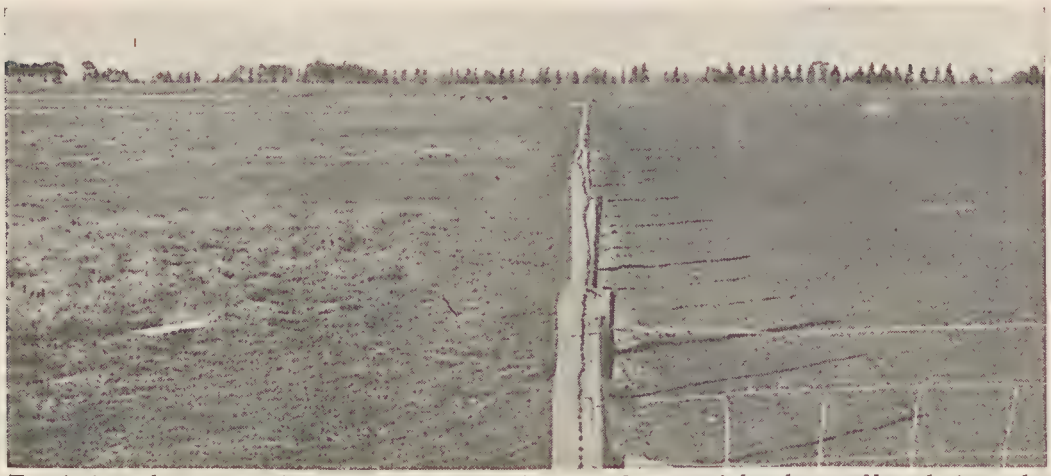


Fig. 2. A comparison of two pasture surveys made in the horse paddock at Werribee in April 1934 and July 1935.



Two irrigated pastures which have been grazed by—Left, horses; right, sheep. Note the irregular character of the pasture in the horse paddock.

This grazing precluded any attempt at carrying out a survey as conditions were not comparable with those obtaining when charting was carried out previously.

Following this intensive grazing with sheep the growth of herbage in the paddock presented a much more uniform appearance, but after the exclusive horse grazing had been reverted to for some months the paddock resumed its former patchy appearance. In the winter of 1937 a survey was scarcely necessary to show that the patches of moderately or lightly grazed herbage were in the same position approximately as in former years. Therefore, one season of grazing with mixed classes of farm stock was not sufficient to correct the effect of the accumulation of dung in these patches or to make any lasting impression on the botanical composition.

Cow Pasture.

The surveyed area was in a pasture paddock which was grazed regularly by the dairy herd. The pasture was established in 1923, the following mixture having been sown:—

	lb. per acre.
Perennial rye-grass	12
Cocksfoot	4
Lucerne	2
Perennial Red Clover	1
Alsike Clover	1
White Clover	1
Strawberry Clover	1
Subterranean Clover	1
Total	23

All the above species were still represented in the sward, but lucerne had almost disappeared and alsike rarely occurred. A small amount of red clover was noticeable in early summer. White and strawberry clovers were well represented, while subterranean clover was well established in the drier patches. Cocksfoot was the most prominent grass, and next in prominence was an excellent type of prairie grass which had come into the sward as a volunteer species. Perennial rye-grass was not so prominent as the other two grasses. Altogether, the sward contained more grass than clover. Top-dressing was carried out regularly each autumn, and 18 to 24 inches of irrigation water was applied each season in six to eight waterings. The paddock of 5 acres was grazed regularly one week out of four or five by a dairy herd of approximately 80 cows. The procedure was to graze the paddock for two to three days with about 50 of the cows which were in full production, allow three days interval, and then to follow up for two to three days with approximately 30 cows which were well advanced in the lactation period.

Each survey was carried out immediately after a grazing. The results of the surveys and estimations are shown in Table 2.

It is apparent that there is a wide divergence between the two observers in judging the various classes of herbage at any one survey. It was inevitable that independent observations should differ in a survey of this kind as the relative heights of the various classes of herbage could only be estimated by eye, time not permitting of an absolute measurement.

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The close intermingling of the various classes and the varying density of the sward further complicated the estimations.

The nearest approach to unanimity was in the recording of the amount of neglected pasture, and as in the case of the cow paddock the amount neglected was comparatively small at most surveys, there was ample opportunity for a wide divergence of opinion in the estimation of the other two classes of herbage. At the time of the spring survey in 1933 unanimity was attained, mainly because at that time of the year growth was so rapid that the various classes of herbage were very well defined. However, although this divergence of opinion occurred at any one survey, from survey to survey the trend of variation for each class of herbage is similar for both methods of estimation.

The trend of variation from season to season and from year to year is shown in Fig. 3. The points for this graph were obtained by averaging the results of the two methods of estimation. Charts of the surveyed area are shown in Fig. 4.

From Figs. 3 and 4 it will be seen that the pasture was most efficiently grazed in the winter period, the lowest amount of lightly and moderately grazed herbage and the highest amount of heavily grazed herbage being recorded at this time. This result was to be expected as the restriction of growth at this period forced the cattle to eat herbage which would have been neglected in periods of rapid growth. The largest amount of neglected herbage occurred through the summer and autumn. This is correlated with the fact that Cocksfoot rapidly produces stems and inflorescences in the spring, and if the plants are not grazed off in the succulent stage in spring

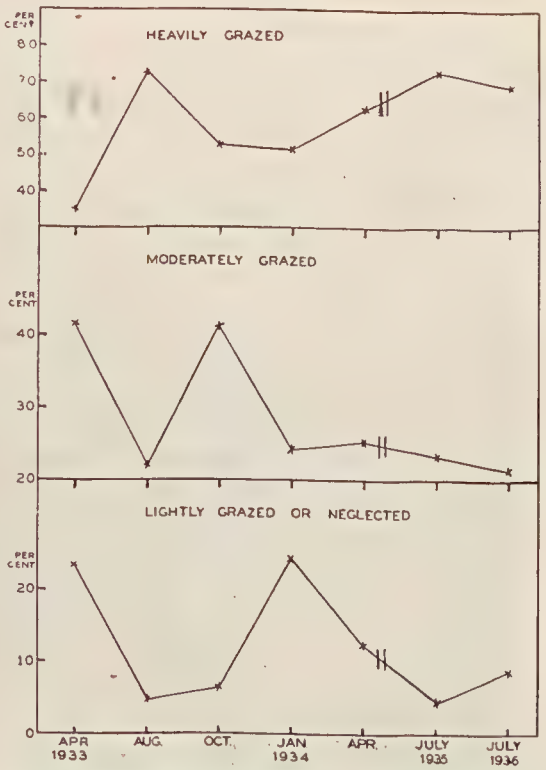


Fig. 3.—Showing the percentages of heavily grazed, moderately grazed, and lightly grazed or neglected herbage from season to season at the State Research Farm.

TABLE 2.—SHOWING PERCENTAGES OF HEAVILY, MODERATELY, AND LIGHTLY GRAZED HERBAGE AT EACH SURVEY IN COW PADDOCK.

Date of Survey.	Percentage of Area Judged as—					
	(a) Heavily Grazed.		(b) Moderately Grazed.		(c) Lightly Grazed.	
	Charts.	Estimated.	Charts.	Estimated.	Charts.	Estimated.
	%	%	%	%	%	%
27th April, 1933	32·10	37·75	52·30	31·56	15·60	30·69
27th to 31st August, 1933	68·46	77·74	27·86	16·15	3·68	6·11
20th to 24th October, 1933	53·08	52·29	41·08	41·05	5·84	6·66
31st January to 1st February, 1934	47·23	56·09	29·73	18·50	23·04	25·09
30th April to 1st May, 1934	54·12	71·34	32·76	17·55	13·12	11·11
17th July, 1935	63·02	81·49	32·02	14·59	4·96	3·92
23rd July, 1936	61·12	78·00	30·30	12·68	8·58	9·32

NOTE.—The last two surveys were carried one year or longer after the preceding survey.

they will persist through the summer in fibrous unpalatable tussocks. A good many of these tussocks persist through the autumn period, after which portions of the tussocks either die and break off or are eaten by the cattle when faced with a shortage of green feed.

The relatively large amount of moderately grazed herbage in spring reflects the quick recovery after grazing rather than neglect by stock because of unpalatability. A relatively low amount of neglected herbage was recorded in the spring since even the longer herbage was green and succulent at that time.

The charts in Fig. 4 demonstrate that there is little permanency in the relative positions of the short and long patches in a pasture grazed

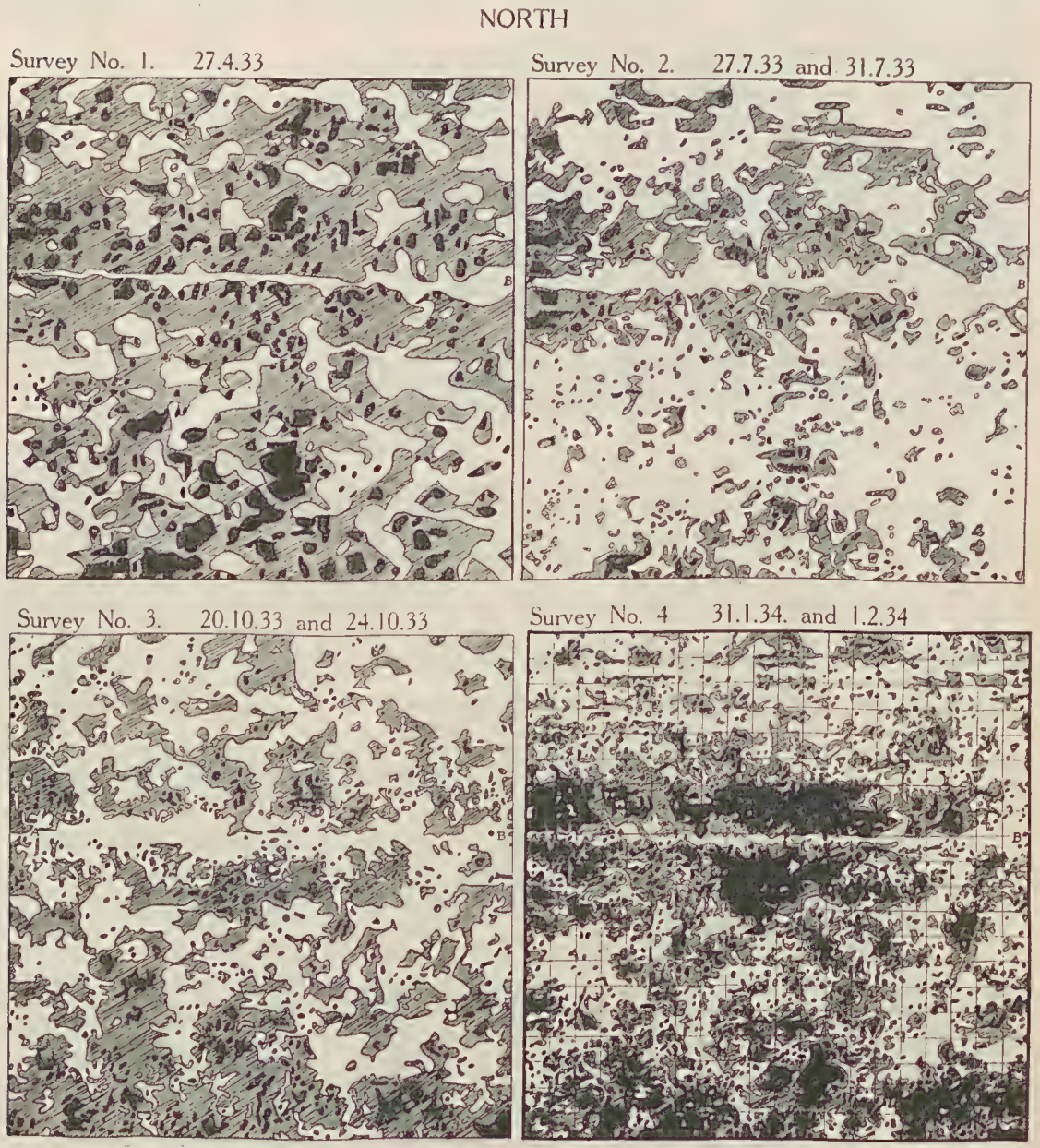


Fig. 4.—Charts showing result of pasture surveys in the cow paddock at the State Research Farm, Werribee, for the period 27.4.33 to 23.7.36. *(For legend see survey on next page.)*

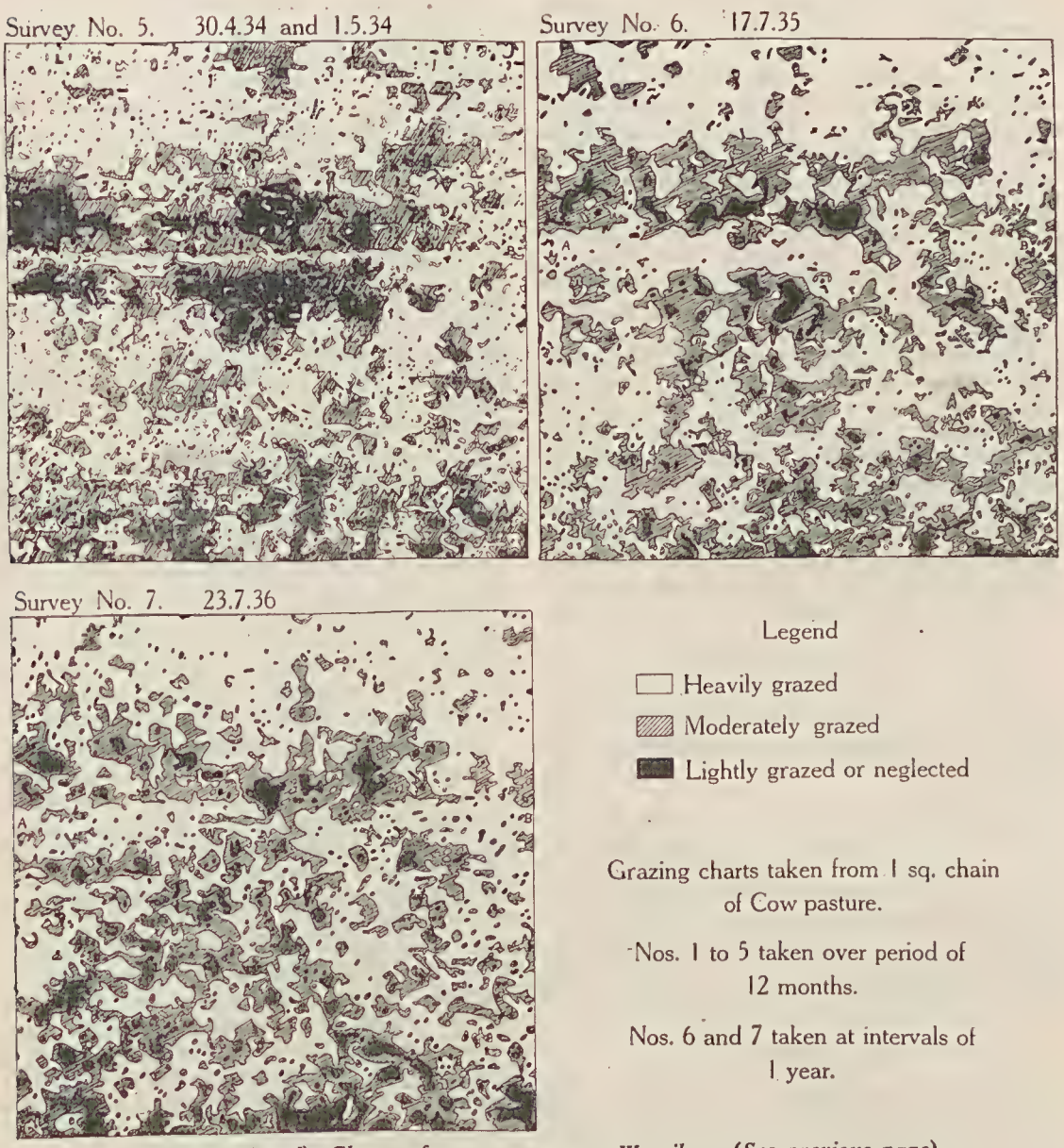

NORTH
Survey No. 5. 30.4.34 and 1.5.34
Survey No. 6. 17.7.35
Survey No. 7. 23.7.36
A
B
Legend
Heavily grazed
Moderately grazed
Lightly grazed or neglected
Grazing charts taken from 1 sq. chain of Cow pasture.
Nos. 1 to 5 taken over period of 12 months.
Nos. 6 and 7 taken at intervals of 1 year.

Fig. 4 (continued)—Charts of pasture surveys—Werribee. *(See previous page).*

by cattle. The line from A to B coincides with a checkbank and the concentration of long herbage on either side of this checkbank was due not so much to the grazing habits of the cattle as to local conditions. On either side of the checkbank the pasture was dominantly grassy, and the comparative absence of clover was due probably to a higher level of the soil with consequent less efficient irrigation. Under such conditions quickly growing annual grasses intrude on the checkbanks and these conditions are noticeable even in a paddock which is intensively grazed by sheep. Also, the building up of the soil to make the checkbank adds to

the fertility, and in season volunteer grasses at the sides of the checkbank grow more rapidly than the sown perennial species in the rest of the bay.

Cows distribute their droppings indiscriminately over the pasture, and unlike horses do not tend to concentrate the dung in definite areas. Over a comparatively short period no part of the pasture is left unfouled, although no part of the pasture is fouled to the extent which occurs in some parts of a pasture grazed by horses. Apparently, in a comparatively short time patches fouled at one grazing "sweeten up" and are eaten readily at subsequent grazings.

Over-grazing with cows occurs less frequently than with any other class of animal, since long before any species is actually punished the dairy farmer will have transferred the herd to another pasture paddock for fear of any reduction of milk production occurring. It is only when there is an actual restriction of plant growth that dairy cattle are kept on a pasture rather long and then usually a supplementary ration of conserved fodder is being given in addition to the pasturage.

Sheep Pasture.

Probably sheep are the most efficient grazing animals. When concentrated on relatively small areas of pasture they will act almost like a mowing machine, and successive grazings by sheep soon give the pasture a uniform appearance. Like cows the sheep scatter droppings indiscriminately over the pasture so that no part is fouled more than another. In the case of cows, however, the droppings often prevent pasture growth on small areas for considerable periods, while with sheep the relatively small droppings do not blanket the pasture, dry rapidly, and the fouling generally is of a very temporary nature.

For some years Rotational Grazing Trials with sheep on irrigated pasture at Werribee have afforded opportunities for a close study of the grazing habits of sheep. Yield sampling and botanical analysis of plots before and after grazing demonstrated the fact that sheep had decided preferences for certain species. Of the grasses, Cocksfoot appeared to be the most palatable, while the legumes generally were more appreciated than the grasses. If the sheep were kept too long on any pasture plot they tended to punish the clovers unduly.

In the case of the Rotational Grazing Trials this over-grazing of the pasture was counteracted by a judicious regulation of the numbers of sheep carried. This regulation of the numbers was necessary as the experiment required that the time factor should not vary throughout the year. However, due cognizance is not generally taken of the fact that sheep will concentrate their attentions to certain species when feed is getting short. This usually leads to much opening up of pasture swards, the actual diminution of valuable species such as white clover, and the intrusion of inferior annual pasture plants and of weeds. There is no indication from the sheep themselves, as in the case of the dairy cows, that a change to another pasture is desirable, and consequently very often the sheep are left on a paddock until almost all the available green feed has been removed, by which time much harm has been done to certain species.

As to the opinion generally held that sheep prefer the short green pick, it is not always considered that while the sheep may actually prefer the short feed that the quality of the fodder may be and usually is too rich. The results from the Rotational Grazing Trials showed that when the herbage was short the ration eaten by the sheep sometimes contained more than 40 per cent. of protein and relatively little fibre. An ill-balanced ration of this kind must eventually cause nutritional disorders.

That sheep will eat readily pasture herbage of a much more fibrous nature was demonstrated definitely when a system of enclosed quadrats was adopted in the Rotational Grazing Trials. Those quadrats each enclosing 1/1000th acre were erected to a regular schedule, and the herbage inside the enclosure was protected from the sheep for eleven weeks. After a botanical analysis had been carried out *in situ* the sheep were allowed access to the herbage. At some periods of the year this herbage would be about 30 inches high after eleven weeks protection. The sheep ate this herbage avidly. What remained on the quadrat area after one grazing through having been trampled and fouled was cleaned up at the next grazing after a recuperation period of eighteen days. At times these small areas were grazed so severely in comparison with the surrounding pasture that bare space appeared in between the plants in the quadrat area although none had appeared in the surrounding pasture sward.

To some extent this apparent preference for the more mature herbage is discounted when it is considered that sheep will tend to graze

heavily in the least prominent species in a pasture. For example, in the Rotational Grazing Trials an apparent preference for weeds and subterranean clover was demonstrated, but weeds constituted less than 1 per cent. and subterranean clover not more than 5 per cent. of the total constituents. The case of the quadrat area in relation to ½ acre of surrounding pasture is analogous. A contributing factor to the palatibility of the long herbage in the enclosure was the complete absence of fouling for a prolonged period.

It would appear that a compromise between the mature fibrous herbage and the short over-rich feed should be arrived at in any method of sheep-grazing. With rotational grazing of relatively small paddocks the longer herbage would be eaten off just as uniformly as would the shorter, even when the sheep are removed before the pasture is eaten down to nearly ground level. Such a method would be in the best interests of both the sheep and the pasture, the sheep from the point of view of general health and the pasture from the point of view of production and the maintenance of a proper balance of the botanical and chemical composition. Frequency of cutting tests have indicated that an interval of four to five weeks should occur between successive defoliations of the pasture plants in order to combine fairly high total production with a suitable balance of the species and of the chemical composition of the fodder produced.

A frequency of grazing trial with sheep has been commenced recently to test the results of the cutting tests in a practical way, and this experiment should afford valuable information as to the best grazing method to adopt.

In final consideration of the relative merits of horses, cattle, and sheep in the economic utilization of pasture, it can be stated that grazing by one class of stock only is in no case entirely satisfactory. Horses are definitely the least efficient grazing animals, and no matter how desirable it may be found to have a pasture area reserved for horses alone, periodical cleaning up of the pasture with cattle or sheep is necessary if waste and deterioration of the pasture is to be avoided. Failing the use of other classes of stock for cleaning up the pasture some form of mechanical renovation will be necessary, e.g., mowing and scarifying.

With cattle grazing a certain amount of waste occurs also, and periodical breaking up of the droppings is essential. Cleaning up a cow pasture with sheep has much to recommend it. An admixture of cattle and sheep grazing has proved successful on many farms, particularly in New Zealand. In the irrigation areas of Victoria the pastures on quite a number of dairy farms have become so highly productive that the farmers concerned are gradually increasing the size of their herds in order to make full use of this production. Additions to the numbers beyond a certain point become an actual embarrassment, particularly when the amount of labour involved is considered. The possibilities of carrying small flocks of sheep, particularly ewes for fat lamb breeding, on such farms should not be overlooked. There is no doubt that they can prove a profitable adjunct to dairying, reduce to some extent the labour problem, and serve the further purpose of maintaining a uniform growth of pasture with the least possible amount of waste occurring.

While sheep are probably the most efficient grazers, where they are the only class of stock carried great care must be exercised to prevent excessive grazing of the pastures.

Grooming the Horse

The objects of grooming horses are cleanliness prevention of disease, and improvement of the animal's condition and appearance. The necessity for, and the amount of, grooming required vary with the conditions under which the horses are kept and used. The better they are fed and the faster they are worked, the greater should be the care exercised in getting the skin into perfect condition.

The importance of grooming as a preventive of disease must not be underrated. While it is true that mange and other skin diseases are not produced by dirt, it is nevertheless equally true that they are most frequently met with, spread with greater rapidity, and are more difficult to eradicate, where dirty conditions prevail.

Extra grooming, especially massage of any kind, has a great effect in improving the general condition of the horse, and is one of the means whereby the body is kept fit as well as clean.

Nut Culture and Production in Victoria

By Edward E. Pescott, F.L.S.

Previous articles on Nut Culture appeared in the November and December, 1937, issues of this Journal.

The Walnut.

(*Juglans regia.*)

THE walnut belongs to the genus Juglans, a group of nut-bearing trees, of which there are several species, some of which bear edible nuts. The walnut varieties which are grown for nut-production, are all derived from the so-called English or Persian walnut. In its wild form, this nut is native to the countries extending from Greece to the Himalayas. It was introduced from Persia into Italy, and hence it became the "Persian" walnut. Commercial trees were distributed from England into America. and so it became known as the "English" walnut. The latter name would distinguish this nut from the several native American species. Botanically it is known as *Juglans regia.*

There are several species of walnuts, native to America and to Japan, which come under our notice, because some of these are now used as stock. Among these are *Juglans nigra,* the American black walnut, *Juglans Californica,* the Californian black walnut, and its variety *Hindsii,* the northern Californian form, and *Juglans Sieboldiana,* the Japanese walnut; all of which have been used for stock. Other forms, the Paradox and the Royal, are hybrids.

Species of walnuts used for stock—Top left, Juglans Sieboldiana; Top right, J. Californica; Bottom, J. Hindsii.

Showing early development of (left) female, and (right) male or catkin buds.

The walnut is a hard-wooded tree, and the trees of some species, particularly the American black walnuts, give a hard timber of a beautiful dark red shade, a timber that polishes well. In its early stages the young growths. twigs, and

Two classes of flowers are produced on the same tree. A. Catkins from first season's growth. B. Female flowers on tips of young spring growths. X. Indicates where growth was cut.

limbs are very tender, the wood being quite soft and the pithy centre often being more or less hollow. The walnut is a deciduous tree in which the sap moves early in spring, and the foolishness of late cutting or late pruning is exemplified when a tear of moisture is seen to exude from a cut made in late spring.

Two classes of flowers are produced on the same tree (see illustrations). "A" represents the staminate male flowers which are known as catkins and upon which the fertilizing pollen is produced, while "B" represents the pistillate female flowers which, when pollinated and fertilized by the pollen, set the nuts. The pollen from the catkins is dropped on to the reddish thread-like pistils, after it has been carried there by insects, or distributed by the wind. Fertilization takes place, and the nuts soon develop. Walnuts are self-fertile, and thus it is not necessary to grow two or more varieties together for the purpose of cross-pollination. But at the same time, it is wise to grow several varieties of both early and late flowering types, so that some safety may be ensured in the event of early spring frosts.

An abundance of pollen is produced in the staminate flowers, and usually there is either sufficient wind or insects to ensure a satisfactory intercarriage of pollen. The old English custom of beating the trees with long pliant rods was a relic of the days of superstition, but of course it ensured a very free distribution of the pollen. This custom also resulted in the breaking of a large number of small tips and lateral ends, which in turn brought about a vigorous young growth upon which the flowers would be borne in the next season.

Seedlings.

For very many years all walnuts grown in Victoria were raised from seed and were planted out as seedlings. There was practically neither budding nor grafting as was the case with all other fruiting trees. Seedlings were raised from recognized, named European and American types and, as a result, very many weaklings were distributed; weaklings because of their hybrid origin. In addition, such trees became very susceptible to what was first known as "black spot," and what subsequently was known to be a bacterial blight, which is now known as "blight." If this bacterial blight did not take toll of the

Selected English seedling walnuts.

Note.—All illustrations of walnuts are natural size.

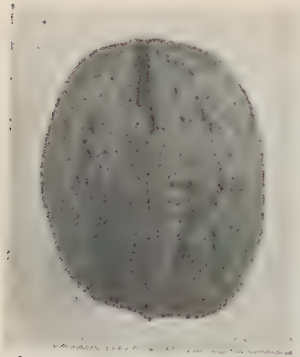
trees for some years, it certainly took toll of the fruit, and undoubtedly many tons of nuts were lost annually owing to this disease.

Walnut culture thus took very little hold in Victoria, except in a few favoured localities, chiefly where the summer is hot and dry, for the bacterial blight is not serious where there is little humidity in spring and early summer. At one time it was thought that if trees were grown in a perfectly drained soil they would not be subject to bacterial attack. But, while it is imperative that soil drainage shall be good, this is certainly not the only factor.

In America, and in South Australia, it has been found that late flowering varieties are practically immune from the blight, so that this is an important factor when planting is being considered in districts that have a considerable spring humidity.

Another type of selected English seedling walnut.

Spraying with Bordeaux mixture and with other types of spray materials has been tried, in an attempt to combat the blight, but no such experiments have yielded satisfactory results in the control of the disease. Other avenues have had to be approached if walnut culture were to succeed.



A promising seedling from Stanley—north eastern Victoria.

Not all seedlings are subject to blight. Large old trees can be seen in many districts in Victoria, trees which are undoubtedly seedlings, which bear large crops of nuts every year, and which are not attacked by blight. Such trees are very common in the old mining areas of the north-east. But it should be remembered that such trees are a case of the survival of the fittest, and where hundreds have died, these few individuals remain.

But all of these seedlings are not immune from the attacks of blight, and these are frequently retained not for fruit, but for shade and beauty. Two such old seedlings are growing in a home garden at Gapsted. In 1937 one of these trees produced over 7,000 nuts, all of which could be used for pickling purposes, if harvested at the right stage.

Stocks.

If walnut cultivation then, were to be successful some other method or methods of raising young trees had to be found, so that trees could be distributed which would more or less be immune from blight, and which would be productive of commercial crops. This only meant that walnut culture must come into line with most other fruit tree culture, and that the trees should be worked, either by budding or grafting, upon suitable stocks, which would give blight-proof trees.

Various seedlings were tried, including seedlings from English varieties and from the American black varieties. The latter proving immune from blight, it was quickly found that *Juglans Hindsii* gave an excellent stock, the species being hardy, vigorous, and thrifty. The Southern Californian variety gave some good trees, especially when planted in moist climates and on light soil.

Good results also were obtained from using stock from nuts of the Paradox and the Royal hybrids. These hybrids were really distributed as ornamental trees for shade and for timber purposes. There is a fine row of the Royal hybrids in an orchard at Kiewa, the trees bearing good crops of nuts each year. The kernels are inedible, but the nuts are now frequently used for stock.

Burbank's Royal hybrid. Used as a stock and for ornamental purposes.

Distribution in Victoria.

A census of walnut growing discloses the fact that ten years ago there were over 11,000 walnut trees in cultivation. By far the larger number of these, nearly 8,000, were located in the north-east. Gippsland had slightly over 1,000, and the central district nearly 1,500. Since that census was taken very considerable plantings have taken place, but no doubt the north-east can still be considered as the main centre of production at the present time.

It is a mistake to suppose that because of these figures, the north-east is the only district in the State where walnuts should be grown. The walnut is classed as a very cosmopolitan tree, and the fact that there are some fine trees in Mildura and Swan Hill, as well as in other districts, is an indication that geographically our planting areas can be considerably extended. A leading walnut expert stated recently that the flat country along the River Murray, beyond Swan Hill, was among the best walnut land that he had seen in the Commonwealth.

Walnut Standards.

No standard for walnuts has yet been set up in Australia. Such a standard is necessary, especially when seedlings are being brought under notice. It will be valuable therefore to note the standard set up by the Royal Horticultural Society of England.

"A good dry walnut should be of a size weighing one-third to one-half an ounce, of light yellowish brown appearance, with a considerably smooth, regular, not deeply pitted, and reasonably stout, well-sealed shell. The kernel should average from 45 to 50 per cent. by weight of the dried nut, and in the unpeeled state be not astringent, the flavour to be mild, sweet (not sugary), and essentially nutty."

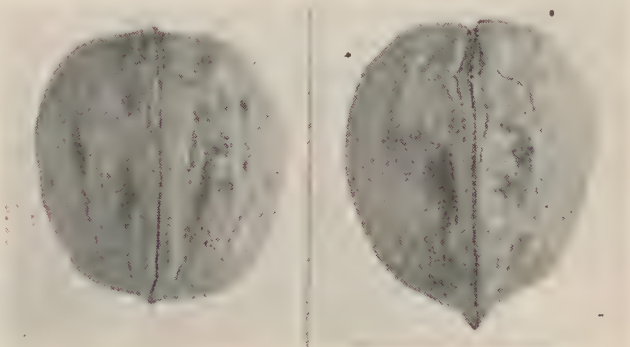
Australian Varieties.

Until recent years, all walnuts planted here were seedlings. Even if named varieties were catalogued and sold, these were grown from seed of the named variety. Consequently, in all walnut districts, there are seedlings of many types; but some of these are of real merit. The principal named seedlings are grown in the north-east, and the development of these types will be watched each year. Seedlings grown by Messrs. Collins, Lindholme, and Noonan show considerable promise; but it will not be advisable to introduce more named varieties unless they are superior to those already named and distributed.

Favourite, or *Gapsted Favourite*, was raised at Wandiligong, where it was the most promising of a large number of seedlings grown on their own roots. It shows excellent resistance to blight, and the tree is a heavy bearer of clean nuts.

The nut is broad, clear brown, with a soft shell and a flat apex. The point is almost absent and the base nearly flat. Suture not prominent, very few veins deep, "pinch" prominent; 36 nuts to the pound, 7 ounces meat to the pound; kernel white and of rich flavour.

Freshford Gem.—This tree was raised by L. J. Wicks, of South Australia. The tree is a strong grower, prolific, and it bears quite early. It is almost blight proof. At an age of twelve years, the parent tree had given six good crops of nuts. It is being extensively planted throughout all walnut-growing districts.



Two Australian Varieties.—Left, Gapsted Favourite; Right, Freshford Gem.

Nut slightly larger than medium, dark brown, smooth; apex prominent and pointed at the end of a broad suture band, which extends right down the nut; base almost flat; shell thin; nut opens easily; kernel white and of very high sugar content. Nuts about 30 to the pound, kernel 8 ounces to the pound. This is one of the best and sweetest flavoured of all walnuts.

Kelvin.—A new nut of recent origin raised at Narracoorte in South Australia. It is a thin paper-shell type, but is somewhat subject to blight. It is a splendid nut if grown where spring conditions do not favour blight development.

The original Kelvin tree at Narracoorte is about 50 years old. Three years ago it had an approximate height of 70 feet and a diameter of 72 feet. It is probably the largest tree in Australia.

Introduced Varieties.

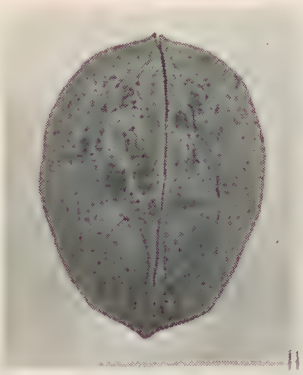
Concord.—Concord is an American variety raised in the district of that name. It is not as vigorous a tree as other varieties, but at Gapsted the trees produce fair crops regularly; they are thrifty and also fairly resistant to blight. It is precocious in bearing; a useful tree, but not the best.

The nut is of medium size, broad and short, with a base inclined to be flat, and wider than the apex; apex is broadly pointed, with a fine point; colour light tan, surface smooth, suture ridges slightly prominent, only a few veins are at all deep; the "pinch" on both sides is very small; meat well formed, medium light coloured and well flavoured; a soft shell, nuts 38 to the pound, weight of meat 8¼ ounces to the pound, flavour fair to medium.

Concord.

Chaberte.—This is an old French variety which was introduced here via California. There are two nuts being grown under this name in Australia—

(*a*) A tree bearing a very large nut, and grown by Mr. L. J. Wicks, of Highbury East, South Australia. The nut is very coarse and rough in appearance, and it is larger and more pointed at the tip than Wilson's Wonder; the meat is quite sweet and just palatable, and the kernel fills the shell fully. This cannot be the true Chaberte, as it does not at all agree with descriptions and illustrations given in American works.



Chaberte.

This, apparently, is also the tree that is being grown by Messrs Schlapp at Gapsted, Victoria, where it is classed as an unsuitable variety, susceptible to blight, and a poor cropper of large nuts. The nuts are hardshell, 18 to the pound, meat 6½ ounces to the pound, kernel dark and of poor flavour.

(*b*) The tree grown by Mr. Coulson in the north-east appears to correspond with the American type. In America the tree is a good producer of small nuts, carrying a plump light coloured meat. It is not considered worthy of planting in California. The nut is oval, a slightly pointed apex, with an almost pointed base; colour grey toned, nut fairly smooth, vein markings quite shallow; nuts 42 to the pound, meat 5¾ ounces to the pound, white, and of good flavour.

Ehrhardt.—This American variety is not well known here, but planting is extending in its country of origin. It is there classed as almost blight-free. It has a tendency to produce heavy crops of high grade nuts. The nut is fairly large, light tan in colour, broad and slightly pointed at

Ehrhardt.

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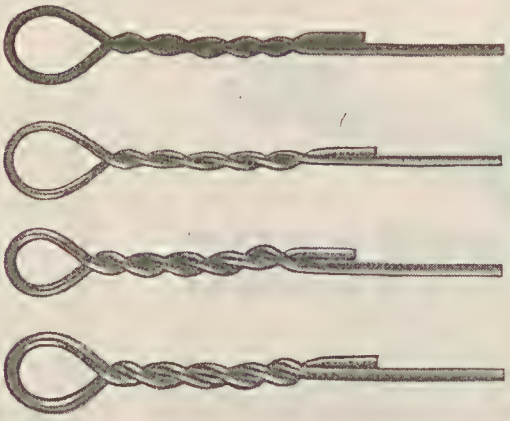

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apex, slightly flattened at base; suture ridges prominent, "pinch" quite deep, sometimes duplicated lower down; veins quite shallow, many rough depressions.

Eureka.—This variety is widely planted in California, but it is hardly known here. It has some disadvantages. The tree is inclined to bear biennially, and it is somewhat subject to blight. But it is a late bloomer, and so, fortunately, escapes frosts; many nuts are carried inside the tree and the harvest season is late. In America the nuts usually bring a higher price than the popular Placentia. It would seem to be a suitable variety in frost-subject localities.

Eureka.

The nut is probably the most elongated of all walnuts, being nearly twice as long as it is broad; the apex and base are nearly equal in breadth, apex nearly blunt, base slightly tapering to a blunt end; surface smooth, sutural ridges not very prominent, veins and surface ridges deeper near the apex and near the "pinch"; "pinch" prominent but shallow; colour dull brown; shell not thin, somewhat hard to crack; meat full, of excellent sweet flavour, averaging about 7½ ounces to the pound.

Franquette.—A French variety, very popular wherever it is grown. It bears a full crop of good quality commercial nuts. It is late flowering, and so escapes the spring frosts. It is very resistant to blight. At Gapsted it is not precocious, but when the tree has attained a good size it is a heavy cropper, carrying splendid nuts. The American report is that "the eating qualities of Franquette are unsurpassed by any variety grown in California." At Gapsted, the tree illustrated on this page, carried 3,000 nuts when it was eleven years old. At the rate of 30 nuts to the pound, with nuts at a price of 1s. per pound, the gross value of the crop of this tree would be £5. The tree, as indeed all of the Gapsted trees are, is very vigorous, and likely to increase in size considerably. There is a record of another Victorian tree having produced 6,000 nuts, and several others 5,000 each.

Franquette.

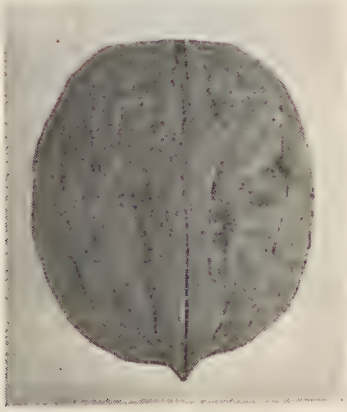
The nut is medium to large in size, very elongated, very pointed at apex, and broad at base; surface medium smooth, sutural ridges prominent, veins and depressions medium to deep; "pinch" deep and prominent, colour light brown; nuts 42 to the pound, meat 7¾ ounces to the pound; medium hard shell, kernel medium, light and very rich.

Mayette.—Mayette is an old French variety, and a choice type. In California it varies quite widely and several types have been evolved, probably from seedlings. The nuts of all varieties are very similar in appearance, and the variations between the types are very slight. It would appear that the Mayette seedlings

Franquette walnut tree at Gapsted—11 years old.

reproduce parental characteristics very easily. The three principal varieties are here discussed.

Mayette Blanc.—This is the true and original Mayette type. The tree is large and prolific. Nut good size, broad, and as wide at base as it is broad. The type has a broad flat base, and the nuts stand up readily on the base; apex almost flat, with very small point; a smooth soft shell, with very small sutures; light coloured; veins quite thin and shallow; "pinch" small and moderately deep; nuts 34 to the pound, meat 7 ounces to the pound, very rich in flavour.

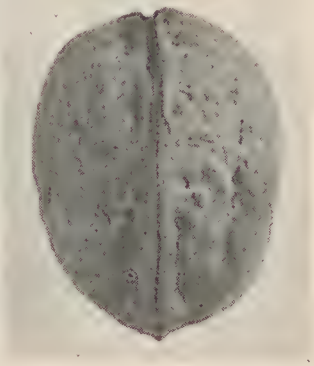


Treyve Mayette.

Mayette Rouge has a reddish-brown shell. Mayette (Californian) is a Californian seedling, medium light in colour, fair to medium flavour; 42 nuts to the pound, meat 7¾ ounces to the pound. It is a late bloomer, but somewhat subject to blight. There are many "stick-fasts," and the tree is a slow grower, bearing very poorly in its early life.

Left, Mayette Blanc; Right, Californian Mayette.

Mayette Treyve.—This is a fine nut with almost pure white meat. In California, it is a poor producer; at Gapsted it is also uncertain, and it does not come into bearing early. It is a mid-season bloomer and fairly resistant to blight. The tree is of pendulous growth and spreading.



Payne.

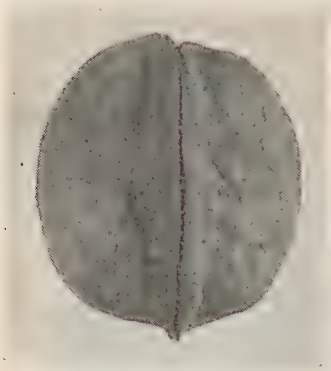
The nut is slightly more pointed than the type, and it is slightly darker in colour. It is a soft shell, 32 nuts to the pound, 7½ ounces of meat to the pound, of medium to good flavour.

Payne.—Another Californian variety, somewhat resembling Franquette, but slightly more elongate. It is a vigorous grower and a precocious cropper, and on this account it is very popular in America. It is an early bloomer, and at Gapsted very susceptible to blight. It may suit a dry climate.

Nut, not quite so flat as Franquette, apex broad and slightly pointed, base rounded; suture prominent, veins shallow; "pinch" thin and prominent; shell soft, dull brown; nuts 32 to the pound, kernel 7 ounces to the pound, kernel white, flavour fair.

Treyve Mayette at Gapsted showing spreading and pendulous habit.

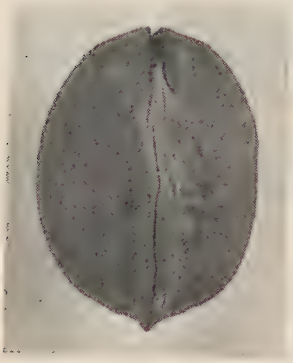
Placentia or *Placentia Perfection.*—This is one of the most popular of all nuts in California, but here it does not seem at all suitable. It may suit a dry climate. In America it is very susceptible to blight; further the nut, being very soft shelled, is liable to open at the apex, if dried or cured too rapidly.



Placentia.

Nuts, not well sealed, open easily; shell thin, but strong; light brown in colour, apex pointed, base rounded, somewhat oval; suture ridges very prominent, very often open at base; shell smooth, veins very shallow; "pinch" not very noticeable, owing to broad ridges of suture. Nuts about 36 to the pound, kernel plump, light coloured, and well flavoured. This nut is imported into Australia from America.

Sorrento.—This nut is frequently imported from America, but it originated at Sorrento, near Naples in Italy. Little is known of the tree. The nut is bright brown, smooth, medium soft shelled, long oval in shape, apex pointed, base rounded and ending in a blunt point; suture not prominent; veins, except for one or two, shallow; "pinch" not prominent; nuts about 34 to the pound, meat of good quality and flavour.



Sorrento.

Trave.—A walnut under this name is listed by L. J. Wicks, of South Australia, as a recent importation from France. It is of Franquette type, but a heavier cropper. It has a white full kernel with thin divisional partitions. The nut is above average commercial size, with a solid smooth shell. It is recorded as blight resistant. Apparently it is quite a different variety from the Treyve Mayette.

Wilson's Wonder.—Originally known as Willson's Wonder, or Willson, this nut has been the cause of very considerable extension of walnut planting in Australia. The extreme precocity of the variety, and the very large nut produced, a nut of quite good flavour, have made it very popular. Whether such a large nut should be planted commercially is open to question. The nut may be too large for commercial sale, except as a novelty, but there is always a considerable section of the community that will be attracted by the size of the nuts. The mild and sweet character of the kernel is in its favour.

Wilson's Wonder is probably the most precocious of all walnuts. Young budded trees, three months from the bud, have been known to bear a number of nuts. Yearling trees have also carried nuts in the first season of planting, while trees in their third year have carried over 100 nuts. A tree thirteen years old has carried over half-a-hundredweight of dry nuts. This precocious bearing habit, combined with a heavy crop, has made the variety somewhat spreading and pendulous. Still, the tree is thrifty in habit, and it can stand the production of a good crop.

Wilson's Wonder.

The variety is not immune to blight, but the attacks are very light, and it is practically immune in dry districts.

In America, it is stated that the largest nuts measure 2 by 3 inches. In Australia, the largest nuts would be 1½ inches wide by 2 inches long. The nut is smooth, brown in colour, medium soft shell, which opens easily; the suture is quite inconspicuous, and large nuts often have three divisions; veins and pits are rather deep, the "pinch" quite inconspicuous; apex rather flat, not pointed; base quite flat, the nut standing up readily. Flesh rather dark, quite sweet; nuts about 16 to 18 to the pound, meat about 7 ounces to the pound.

[This article will be concluded in a subsequent issue.]

Millewa Crop and Fallow Competition, 1937

Repor of Judge: H. L. Hore, B.Agr.Sc.—Officer in Charge, Mallee Research Station—Walpeup.

Experimental Plots—Werrimull.

TWENTY-SIX (fifteen fallows and eleven crops) entries were submitted for judging in the 1937 crop and fallow competition, conducted by the Millewa Agricultural Society, in the north-west Mallee.

The season in the Millewa was a satisfactory one, 927 points of rain being recorded at Werrimull for the period 1st January to 31st October. Of that total, 715 points were received between 26th April and 18th October. The absence of good falls during September and early October caused some reduction in yield, and considerable anxiety to those concerned, but the crops held out well, and the best wheat yields since 1932 were expected. The crops inspected in the competition were estimated to return an average yield of nineteen bushels per acre.

All the competition crops were sown between the end of April and the end of May. In general, they were fairly free from disease, although in most entries flag smut and loose smut were present to a minor extent. In a few crops small take-all patches and "dead-heads" were noticed, and in each of these cases the land had been fallowed from either wheaten stubble or from grass land. The growing of oats in the rotation helps to combat take-all, and a further point of interest is that barley grass is a host for this disease.

The popularity of the varieties Ranee 4H and Ghurka under Mallee conditions was indicated by the fact that all the crops in the competition had been sown with these wheats. Generally Ranee 4H had made the better showing of the two.

The average application of seed was 43 lb. per acre, and superphosphate 37 lb. per acre. These amounts approximate closely to the quantities recommended for the Millewa, where approximately 45 lb. per acre of both seed and superphosphate should meet the requirements. Experiments have shown that the quantity of seed sown (between the limits of 30 and 75 lb. per acre) does not appear to have much effect on the yield of the wheat crop under Mallee conditions, and, although the response to superphosphate at the experimental plots at Werrimull has not been marked until this year, general observations and tests at numerous other Mallee centres indicate that a light dressing of 45 lb. per acre on the wheat crop on fallowed land should be profitable in the Northern Mallee.

The popularity of deeper ploughing appears to be increasing, and this year two-thirds of the competitors had ploughed their competition fallows to a depth of 3 inches or deeper. Cultivation trials at the Mallee Research Station have shown that the yields are slightly increased

by deeper ploughing, which appears also to assist, to a limited extent, in preventing the land from drifting. Most of those who plough deeper than 2½ inches are in agreement on this latter point, and, furthermore, it was noted in the competition fallows that the deeper mulches appeared to be holding the moisture better at the time of judging.

A practice which is extending in the Millewa is that of leaving the ploughing of sandhills till very late in the season. Two reasons are advanced for this procedure. It is contended that more sheep feed is available, and that the barley grass and other herbage (mainly weeds) which make headway during the winter, when ploughed in later help to prevent the soil from blowing away. This may be so to a limited extent, but it is suggested that the same objectives could be more fully met, and with better results by the adoption of the "cover crop" fallow on hills which are subject to drift. This involves ploughing the hills in the usual way early in the winter, and sowing them later with a cover crop of oats during the next working, which usually takes place about the end of August or early September. In some cases the oats may be combined in on the hills as soon as the seeding of the wheat crop is completed. The area is then not worked again till after the summer, but the oat crop obtained is allowed to grow till a firm roothold is developed, and thereafter is grazed off judiciously to prevent it from seeding; the roots and stalks are left to hold the soil over the summer months.

This method of preventing the sandhills from drifting is becoming increasingly popular, and the additional feed obtained is of considerable value to those farmers who carry sheep on their holdings.

The detailed awards are set out in Table I.

In the Mallee land section, first place for the fallow and crop aggregate was won by Mr. J. Horn, of Karrawinna North. The variety shown was Ranee 4H. The land had been prepared by ploughing with a mould-board plough to a depth of 3½ inches in July. It was cultivated with a combine in September and again in January, and sheep were used whenever required. The crop was combined in, with light harrows behind, during mid-May. Seed which had been wet-pickled (with 1 lb. formalin in 45 gallons water) was sown at 45 lb. per acre, with superphosphate at the same rate. The crop showed a few weak patches and some loose smut, but it was well headed and a very creditable exhibit.

Mr. L. Rogers, of Karrawinna, gained second place in this section with a crop of Ghurka, which had been sown in early May with 40 lb. per acre of both seed and superphosphate. Portion of the area shown was on a heavy flat, and the crop thereon had suffered during the dry spell in September.

In the mixed land section Mr. H. N. Arnold's crop was outstanding. It was grown on the fallow which had gained first place in this section last year. The variety was Ranee 4H, which had been dry-pickled and combined in

TABLE I.—75 ACRES OF FALLOW 1936, AND WHEAT CROP GROWN THEREON 1937.

Competitor.	Variety.	Yield.	Purity and Type	Absence of—		Evenness.	Crop Total.	Fallow Total.	Fallow and Crop Total.
				Weeds.	Disease.				
Maximum Points ..	.. ..	35	20	15	15	15	100	100	200
			Mallee Land Section.						
J. Horn	Ranee 4H ..	26	18	13	14	13	84	84	168
L. Rogers	Ghurka ..	19	17	13	14	12	75	90	165
S. Dietrich ..	Ghurka ..	19	17	12	14	12	74	86	160
M. Gaunt	Ranee 4H ..	15	18	14	14	13	74	75	149
			Mixed Land.						
H. N. Arnold ..	Ranee 4H ..	29	18	14	13	14	88	86	174
D. Mason	Ghurka and Ranee 4H	21	18	12	14	13	78	85	163
G. D. Rogers ..	Ghurka ..	25	17	12	14	13	81	79	160
G. J. Douglas ..	Ghurka ..	15	17	12	12	12	68	82	150
			Pine and Belar Land.						
F. Rose	Ranee 4H and Ghurka	33	19	13	13	14	92	95	187
E. Ruchel	Ranee 4H ..	35	18	13	14	13	93	93	186
J. Hodges	Ghurka ..	30	18	14	14	13	89	91	180

after 20 points of rain at the end of April. Seed was sown at the rate of 35 lb. and superphosphate 30 lb. per acre.

The wheat was very dense and demonstrated how a lightly seeded crop can stool out to form heavy growth. It contained very few weak patches, and was one of the most even crops inspected.

Mr. D. Mason's exhibit, which consisted of both Ranee 4H and Ghurka, gained second place in the aggregate for this section. It was sown early in May with 43 lb. of seed and 36 lb. of superphosphate per acre. The Ranee 4H had made the better showing of the two varieties.

In the section grown on pine and belar land, very little separated the two best crops. Mr. F. Rose, however, won the aggregate for fallow and crop.

Mr. Ruchel's crop was estimated to yield the better, and gained the highest points for all crops in the competition, and thus won the Hodges' Cup.

Mr. Rose's crop comprised the varieties Ranee 4H and Ghurka. The land was prepared by ploughing 3¼ to 4 inches deep at the end of June. It was then harrowed in August, cross scarified in early October, and again at the end of February, and combined in with 40 lb. seed and 41 lb. of superphosphate per acre.

Mr. Ruchel's crop was Ranee 4H, and the land had been prepared in a similar manner. The crop was sown with a combine, with harrows attached, in mid-May. Fifty-six lb. of seed and 60 lb. of superphosphate were sown per acre.

The Fallows.

Most of the fallows submitted for judging were in very good condition. In a few cases, however, weeds, the control of which is one of the most important features in fallowing, had not been suppressed either by cultivation or the use of sheep. The best time to eradicate weeds is when they are still in the seedling stage.

The competition is for the best 75 acres of fallow land, and is divided into three sections according to the type of timber which the land originally carried. A cup has been donated by the *Sunraysia Daily* for presentation to the competitor obtaining the highest award for a fallow, irrespective of the section. The honour this year went to Mr. H. N. Arnold.

In the Mallee land section, Mr. F. Rose's fallow was placed first. He had made an excellent job on country which is difficult to make attractive. The area was mostly Mallee flat with a lot of limestone showing on the surface. It had been ploughed 4 inches deep at the end of June with a mould-board plough from grazed-off oaten stubble. It was then harrowed and later scarified in mid-September and again in late October. It was sheeped when necessary.

Mr. S. Dietrich, who was second in this section mould-board ploughed 2½ to 3 inches deep in late June, harrowed in September, combined at the end of October and sheeped the area. The weeds had not been effectively eradicated by these operations.

In the mixed land section, Mr. H. N. Arnold showed a very attractive fallow, prepared on land which carried short oaten stubble. The area had been mould-board ploughed 3½ inches deep at the end of June, cross-scarified in September and again in October. Sheep had been used effectively.

Mr. F. H. Baker's entry, which was placed second, had been prepared somewhat similarly, being mould-board ploughed 3 inches out of grass land at the end of July, scarified early in September, combined in October, and sheeped.

In the pine and belar section there was little to choose between the fallows submitted by Mr. J. Frazer and Mr. E. Ruchel. Both were on undulating country. Mr. Ruchel ploughed his land a good 3 inches deep in late June to early July. It was harrowed at the end of July, scarified late in August, and spring-toothed in mid-October. Mr. Frazer ploughed 3 inches deep from oaten stubble in July, cross-combined in September and again in October. Both entries had been sheeped.

TABLE 11.—THE FALLOWS.

Competitor.	Moisture.	Mulch.	Absence of Weeds.	Cultivation and Seed Bed.	Total.
Maximum Points ..	**25**	**25**	**25**	**25**	**100**
Mallee Land.					
F. Rose ..	23	25	25	24	97
S. Dietrich ..	24	23	22	23	92
L. Rogers ..	23	23	21	22	89
S. H. Bennett ..	22	22	23	22	89
S. Rogers ..	22	23	20	22	87
Mixed Land.					
H. N. Arnold ..	25	24	25	24	98
F. H. Baker ..	24	23	23	24	94
J. Horn ..	24	23	23	23	93
G. J. Douglas ..	23	22	22	22	89
E. Adams ..	22	21	22	22	87
Pine and Belar Land.					
E. Ruchel ..	25	24	24	24	97
J. Frazer ..	24	24	24	24	96
L. Weatherhead ..	24	24	22	23	93
W. C. Williamson	22	22	19	21	84
S. C. Mountford ..	21	21	20	20	82

Wheat Trials in the Goulburn Valley

Tests at Invergordon

THE experimental plots at Invergordon, which are conducted on the property of Messrs. W. White and Son, are situated on red loamy land with a strong clay subsoil, characteristic of large areas to the east of Numurkah.

The wheat variety tests comprise a yield trial with nine varieties of wheat, including four new crossbreds. The trials are laid out on the replicated system, and sown on land cropped under the three-course rotation—fallow, wheat, oats.

The plots were sown on 8th June with 75 lb. of seed and 1 cwt. of superphosphate per acre.

Yields in 1937, and the average results since 1934 are shown in Table I.

TABLE I.—WHEAT VARIETY TRIALS—INVERGORDON.

(Yields in Bushels per Acre.)

—	1937.	Average 4 years, 1934–37.	Average 2 years, 1936–37.
Baldmin	33·4	40·7	39·0
Major x Ranee	32·2	..	..
Ranee x Free Gallipoli ..	31·0	..	..
Major x Free Gallipoli ..	30·4	..	..
Ghurka x (Cur. x Maj. x Glp.)	29·3	..	..
Dundee	28·8	..	33·8
Ghurka	28·4	36·5	32·6
Ranee 4H	27·9	35·9	33·4
Free Gallipoli	26·9	34·2	32·3

The plots were sown under ideal conditions after an inch of rain in June, but with light falls in winter the growth was very backward. Very dry weather in early spring had a further adverse effect on the crops, but substantial rains in October were particularly beneficial, and although fairly good yields were harvested the returns were not so high as in the previous two years. The season at Invergordon, however, was generally superior to the conditions experienced over the bulk of the wheat areas in the north and west of the Goulburn Valley.

A feature of the tests was the performance of the variety Baldmin. Over the four-year period 1934-37 this wheat returned the highest average yield of 40.7 bushels per acre, compared with Ghurka, 36.5; Ranee 4H, 35.9; and Free Gallipoli, 34.2 bushels per acre. Baldmin also has been the leading variety in the nearby experiments at Dookie College, and it appears to be a very prolific wheat in this portion of the State.

Baldmin is a fairly tall, white-chaffed variety which matures considerably earlier than Ghurka, and is of special interest, as it produces flour of superior quality to the more commonly grown wheats. In some seasons, however, it shows a tendency to be weak in the straw, but despite this it has returned high grain yields.

Since the inception of these tests in 1934, Ghurka has given the second highest average return, thus demonstrating its suitability to this area. Dundee, which has been tested at Invergordon for two years only, was slightly ahead of Ghurka over this period. Dundee is a brown-chaffed wheat, of medium height, mid-season in maturity, and practically resistant to flag smut disease.

On bulk areas in this locality Dundee has given some very good yields, but it will be further tested before being recommended for extensive sowing.

Another feature of the experiments this year was that the four new crossbred wheats which were introduced into the trials this season all gave a higher yield than the standard varieties, Ghurka, Ranee 4H, &c. Further tests over varying seasons will be undertaken with these new varieties.

Wheat Manurial Trials.

The wheat manurial trials, which were designed to ascertain the most payable application of superphosphate to use on well fallowed land, were sown on 9th June with the variety Ghurka at 75 lb. per acre. In the season under review a marked response to the

manure was obtained, the increased yields over the "no-manure" plots with the various dressings being:—Super. ½ cwt., 7.4 bushels per acre; super. 1 cwt., 9.0; super. 1½ cwt., 13.2; and super. 2 cwt., 13.4 bushels per acre.

The detailed yields and average results since 1934 are set out in Table II.

TABLE II.—WHEAT MANURIAL TRIALS—INVERGORDON.

(Yields in Bushels per Acre.)

—	Yield, 1937.	Increase Due to Super.	Average 4 years, 1934–37.	
			Average Yield.	Increase Due to Super.
No manure ..	19·3	..	26·3	..
Super. ½ cwt. per ac.	26·7	7·4	32·5	6·2
Super. 1 cwt. per ac.	28·3	9·0	34·0	7·7
Super. 1½ cwt. per ac.	32·5	13·2	35·5	9·2
Super. 2 cwt. per ac.	32·7	13·4	36·0	9·7

On reviewing the results over the four-year period, it will be seen that a substantial increase in yield is obtained from the use of superphosphate in this locality, the average increase ranging from 6.2 bushels per acre to 9.7 bushels per acre with the various dressings.

In considering the extra net monetary return from each application, the cost of the manure has to be deducted. On this basis, with wheat valued locally at 4s. per bushel and super. at £4 2s. per ton (including freight), the super. ½ cwt. dressing gives a net increased return of 22s. 9d. per acre; super. 1 cwt., 26s. 8d.; super. 1½ cwt., 30s. 7d.; and super. 2 cwt., 30s. 6d. per acre.

With wheat at the lower level of 3s. per bushel, the extra net returns are:—Super. ½ cwt., 16s. 6d.; super. 1 cwt., 18s. 11d.; super. 1½ cwt. 21s. 4d.; and super. 2 cwt., 20s. 9d.

These results show that liberal dressings of superphosphate are profitable on fallowed land in this district. Under conditions similar to those on the experimental site, an application of 1½ cwt. per acre, at current prices, would be payable.

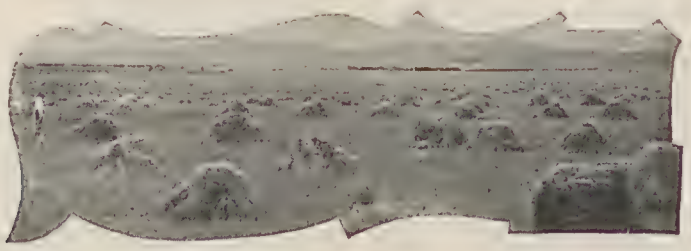
Oat Varieties.

The oat trials, which were designed to determine the varieties best suited to the Goulburn Valley, were sown on 10th June on wheaten stubble land with 60 lb. of seed and ½ cwt. of super. per acre. The hay yields obtained this season, and the average results for the past two years are shown in Table III.

TABLE III.—OAT VARIETY TRIALS—INVERGORDON.

—	Hay Yield, 1937. cwt./ac.	Hay Yield, Average 2 years, 1936–37. cwt./ac.
Algerian Selection P5 ..	25·4	26·9
Dawn	24·7	..
Belar	21·9	24·7
Algerian	23·5	24·4
Fulghum	21·8	..
Palestine Selection ..	20·8	..

Algerian P5, which is an improved selection of the original strain, has outyielded the standard Algerian oat in its two years of test. Dawn, also, gave a good hay yield in its first trial at this centre and, as it has given outstanding results as a general purpose variety in other districts, should be tried by northern district farmers.



London Markets

Weekly Prices

The following information as to prices offering in London for the principal Victorian primary products has been taken from cablegrams received each week by the Department of Agriculture from the Victorian Agent-General in London.

Product.	Price for Week Ending—			
	31st December.	7th January.	14th January.	21st January.
	d.	*d.*	*d.*	*d.*
Lamb, 1st quality, Victorian .. .. 29–36 lb. ..	7¾	7½	7¼	7⅛
Lamb, 1st quality, Victorian .. .. 37–42 lb. ..	7⅝	7½	7¼	7⅛
Lamb, 1st quality, other States .. 29–36 lb. ..	7⅝	7⅜	7⅛	7
Lamb, 1st quality, other States .. 37–42 lb. ..	7⅝	7⅜	7⅛	7
Lamb, 2nd quality, Victorian .. .. 28 lb. and under	7¼	7	6¾	6¾
Lamb, 2nd quality, Victorian .. .. 29–36 lb. ..	7	6¾	6⅝	6½
Lamb, 2nd quality, other States .. 28 lb. and under	7⅛	6⅞	6¾	6⅝
Lamb, 2nd quality, other States .. 29–36 lb. ..	6⅞	6⅝	6½	6⅜
Lamb, 3rd quality, all States .. .. 28 lb. and under	6⅝	6½	6¼	6¼
Lamb, 3rd quality, all States .. .. 29 lb. and over	6½	6¼	6¼	6¼
Mutton wethers and/or maiden ewes .. Under 40 lb. ..	4¾	4¾	4¾	4⅝
Mutton wethers and/or maiden ewes .. 41–48 lb. ..	4¼	4¼	4¼	4¼
Mutton wethers and/or maiden ewes .. 49–56 lb. ..	4⅛	4⅛	4⅛	4⅛
Mutton ewes .. .. Under 40 lb. ..	4¾	4¾	4⅝	4½
Mutton ewes .. .. 41–48 lb. ..	4⅛	4¼	4⅛	4
Beef, frozen ox hinds .. .. .. 145–210 lb. ..	4¼	4¼	4¼	4⅜
Beef, frozen ox crops, weights corresponding	3⅜	3⅜	3⅜	3⅜
Beef, chilled ox hinds .. .. 145–210 lb. ..	5	5¼	5¼	5⅜
Beef, chilled ox crops, weights corresponding	3½	3⅝	3⅜	3¾
Pork, Australian 1st quality .. .. 60–80 lb. ..	7⅝	7¾	7¾	7⅝
Pork, Australian 1st quality .. .. 81–100 lb. ..	7½	7½	7½	7⅜
Pork, New Zealand, 1st quality .. 60–80 lb. ..	7⅝	7¾	7¾	7⅝
Pork, New Zealand, 1st quality .. 81–100 lb. ..	7½	7½	7½	7⅜
	s.	*s.*	*s.*	*s.*
Bacon, Canadian .. .. .. per cwt. ..	90	84	84	84
Bacon, Empire (cured in England) .. per cwt. ..	89	83	83	83
Bacon, Danish .. .. .. per cwt. ..	100	96	96	96
Butter, unsalted, choicest grade .. per cwt. ..	110–111	110–111	112–113	112
Butter, unsalted, 1st grade .. .. per cwt. ..	109	109	111	110
Butter, unsalted, 2nd grade .. .. per cwt. ..	..	..	..	..
Butter, unsalted, pastry grade .. per cwt. ..	..	..	..	..
Butter, salted, choicest grade .. .. per cwt. ..	109–111	110–111	111–112	108–109
Butter, salted, 1st grade .. .. per cwt. ..	108–109	109–110	110–111	107–108
Butter, salted, 2nd grade .. .. per cwt. ..	107	107–108	109–110	106–107
Butter, salted, pastry grade .. .. per cwt. ..	106	105–106	..	106
Butter, Danish .. .. .. per cwt. ..	144	133	132	131
Market (butter)	Lower prices	Firm	Quieter at close	Dull

Butter Production and Export

The following table shows :—

(*a*) Factory production of butter and cheese in Victoria for the period July to November, 1937, compared with the corresponding period of 1936; and

(*b*) Quantities and percentages of various grades of bulk butter examined in Victoria for export from 1st July, 1937, to 25th December, 1937, in comparison with the corresponding period of 1936.

FACTORY PRODUCTION OF BUTTER AND CHEESE IN VICTORIA (QUANTITIES IN TONS).

Month.	Butter.		Cheese.	
	1937.	1936.	1937.	1936.
July to September	11,892	12,711	1,372	1,141
October	8,823*	8,635	1,020*	748
November	9,524†	9,142	1,080†	819
Totals, 5 months	30,239†	30,488	3,472†	2,708

* Revised. † Subject to revision.

BULK BUTTER EXAMINED IN VICTORIA FOR EXPORT (QUANTITIES IN TONS).

Period.	1937. How Graded—				Total.	Period.	1936. How Graded—				Total.
	Ch.	1st.	2nd.	Pty.			Ch.	1st.	2nd.	Pty.	
1st July to 27th November ..	12,055	3,985	737	39	16,816	1st July to 28th November ..	12,005	4,189	958	101	17,253
28th November to 25th December ..	3 429	2,041	369	24	5,863	29th November to 26th December ..	4,244	1,295	390	54	5,983
Totals 1st July to 25th December ..	15,484	6,026	1,106	63	22,679	Totals 1st July to 26th December ..	16,249	5,484	1,348	155	23,236
Percentages ..	68·3	26·6	4·8	0·3	..	Percentages ...	69·9	23·6	5·8	0·7	..

Tubercle Free Herds

The following herds have been declared free of tuberculosis under the scheme conducted by the Department of Agriculture. Under this scheme a tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual physical examinations and tuberculin tests, or, upon disclosure of infection, three semi-annual, successive physical examinations and tuberculin tests applied by a State Veterinarian or by a qualified and registered veterinarian who is approved by the Chief Veterinary Inspector for that purpose.

ACCREDITED TUBERCLE FREE HERDS.

Herd Number.	Name.	Address.	Number in Herd.	Herd Number.	Name.	Address.	Number in Herd.
1	State Research Farm	Werribee ..	259	6	Reid, Ralph G. ..	"Holmwood," Koo-wee-rup	99
2	Warragul High School	Warragul ..	35				
3	Payne, A. E. T. ..	"Yarra View," Lilydale	80	7	Harris, J. W. ..	"Rowena," Clyde	72
4	Dennis, Mrs. A. A. ..	Frankston ..	14	8	School of Horticulture	Burnley	8
5	Lady Talbot Milk Supply Company	Cranbourne	418		Lawrence, P. H.	"Rainga," Tarrawarra	59

By J. L. Provan, B.Agr.Sc., Horticultural Research Officer.

The Orchard.

HARVESTING operations in the orchard will continue actively throughout February. This season, varieties are ripening from ten to fourteen days earlier than usual, and, therefore, fruit which normally is harvested early in February was picked late in January. The apple harvest will continue with Cleopatra, Jonathan, London Pippin, Delicious, and Dunn's varieties. Grand Duke and President plums will be picked during February, and the late peaches—Millicent, Doncaster Crawford, Katherine Ann, and Lorimer—will complete the dessert peach crop. The end of the Williams pear crop and B. Bosc and Packham's will be picked this month. Harvesting of the canning peaches will continue during February.

It is important that growers picking fruit for cool storage should realize that it is maturing earlier this season. Failure to take this fact into consideration, and to harvest the fruit earlier than usual, may result in the storage life of the fruit being considerably reduced. Peaches intended for storage should be picked when the ground colour is a whitish-green and a fair amount of blush has developed. If picked at this stage, they may be stored successfully at 32 deg. F. for a period up to five weeks.

An interesting report of the investigations undertaken on the harvesting and storage of pears commenced in the January number of this *Journal*, and is continued in the present issue. Every pear-grower should study this article, as it contains much useful information.

The objects of this experimental work were to determine the effect of picking time and temperature on the storage life of various varieties of pears, and the factors responsible for the development of the disorders of mealiness, core breakdown, and scald. During the four seasons in which the experiment was in progress the optimum picking time for pears did not vary by more than one week from year to year. This time can be detected by the change of colour from a very dark green to a paler green. If pears are picked too early, they fail to develop good quality on ripening after storage. Pears picked too late are of excellent quality on ripening, but have a shorter storage life. A reasonably long storage

life with good quality on ripening can be expected if pears are picked at the optimum stage of maturity. The experiments showed further that over the range 30 deg. to 45 deg. F. the storage life of the Williams pear is decreased by one-fifth for a rise in temperature of 2 deg. F. Growers should also realize that any delay in placing fruit in store after picking considerably reduces the storage life.

The optimum picking time for apples is determined by the appearance of a greenish-yellow colour in the fruit. If picking is delayed beyond this stage, the ground colour will advance to yellow, the storage life decreases, and mealiness is liable to develop.

The best storage temperature for plums is 32 deg. F. and if they are picked when fully grown—the red and blue varieties showing only the first signs of colour and the yellow varieties still hard and green—maximum storage life is obtained.

Codling moths were particularly active during January. This is unusual, and indicates that the problem is liable to be a serious one this season. A large third brood can be expected in many centres in March, if control measures are inadequate. Growers are advised to work in close co-operation with the orchard supervisors and to apply the sprays at the most effective periods.

Where red spider continues to increase, the addition of 1 pint of nicotine sulphate to the lead arsenate, or white oil, cover sprays for codling moth, will reduce the infestation. A large population of red spider will seriously affect the nourishment of the flower buds for next year's crop. To combat this pest, it is essential to spray the underside of the leaves.

Apple and pear trees may be budded during February. Budding of citrus trees can be delayed until March. Free bulletins on "Budding of Deciduous Trees" and "Budding Citrus Trees" are available on application to the Director, Department of Agriculture, Melbourne, C.2.

This season, many growers will be packing their fruit to "counts" instead of "sizes," and this should result in a considerable improvement in the presentation of Victorian fruit on the overseas and local markets. Packing charts for Yates apples and Josephine pears are available free on application to the Department.

The Flower Garden

By A. W. Jessep, M.Agr.Sc., B.Sc., Dip.Ed., Principal, School of Horticulture, Burnley.

Although the season has been dry, provision must be made this month for sowing the seed of the winter-blooming flowers. In the summer the seedlings must be carefully tended, or they may perish during a hot north wind.

Special preparation for seed sowing should be carried out. If the seeds are going to be sown in boxes, these should be about 4 inches deep and have drainage holes in them. Place a layer of paper in the bottom of the box and almost fill it—to within about half an inch of the top—with fine light soil, which should then be consolidated. Thoroughly water the soil and then sow the seeds. Just cover them with light sandy soil or with screened, well-rotted, dry stable manure. Place the box in a sheltered position and do not allow the soil to become dry. Water carefully with a fine spray, so as not to unduly disturb the germinating seedlings.

Iceland Poppies.

If the seeds are to be sown in the open ground, prepare it very carefully, using a light soil. Consolidate the surface and give it a careful and thorough watering. Sow the seeds either in drills about 2 to 3 inches apart or broadcast them. If broadcast, divide the seed into two equal parts and sow the one half and then the other at right angles to it. This

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ensures a more even distribution. Cover as with the seed-box method, and then protect the germinating seeds against the dry weather and birds by placing wire netting over the bed and spreading palm leaves or such like on it to break the direct rays of the sun.

Another convenient method is to have a hessian cover which can be used to protect the seedlings from the hot sun, but after the seedlings are well above the ground it should be used only during the hottest part of the day. The hessian should be at least 1 foot above the seed bed.

The seeds to be sown in February should include Iceland poppies, winter sweet peas, calendulas, *Primula malacoides,* pansies, and violas. All but the sweet peas should be sown in a seed bed and transplanted in about six weeks' time.

Of these plants the Iceland poppy is undoubtedly the most popular. It is easy to grow and produces a large number of flowers throughout the winter months. Poppy seeds are very small and when sown must be just covered with fine sand or soil and carefully shaded until they are well above the ground. Gradually harden them off before transplanting about six weeks after germinating. Transplant about 8 inches apart, and do not allow the soil to become too dry. As they are sometimes attacked by a fungus about ground level, spray with Cheshunt compound or give a very light dusting with copper carbonate in April, particularly if the weather becomes damp. They should commence flowering in May.

There has been much improvement in this plant of recent years with regard to both size and colour of the flowers and length of stem. In addition to the well-known yellow, white, and orange colours, there are now available the Coonara pinks and the pastel shades of the Gartford Giants. No garden can afford to be without these winter-flowering plants.

Dahlias now require special attention. They should be given a dressing of blood and bone or market garden manure at the rate of about 2 to 3 oz. per square yard and well distributed over the whole area, not merely around the individual plants. Follow this by a good watering, and in a few days go over the area with a Dutch hoe and then add a mulch of straw farmyard manure. The object of the mulch is to keep the moisture in, keep the ground cool, prevent puddling when watering, and to prevent the ground setting hard when walking around the plants.

Tie up and disbud the plants as required. The chief reason for disbudding dahlias is to increase the size of the remaining flowers. In most varieties the two outside flower buds are removed while still quite small and the central and larger flower bud retained. In some varieties, however, e.g., Mr. Crowley, this central bud has a short stem, and it is usually removed, and one or both of the side buds, which produce longer stems, are retained for flowering.

Vegetables.

Provision for winter vegetables necessitates the sowing of seeds during this month. Cabbage and cauliflower seed should be sown in specially-prepared seed beds and treated as indicated above for flower seeds. They should then be transplanted in about six weeks' time. Good early varieties of cabbages are Early Jersey Wakefield, Best of All, and Enfield Market. Good all-round varieties are Succession, Surehead, and Copenhagen Market. The early varieties should mature about three months after transplanting. Early Jersey Wakefield sown this month, transplanted in March, should be ready for cutting in June.

Cauliflowers take a little longer than cabbages to mature. Sow an early variety such as Phenomenal Early or Early London, and it should mature in about five months. Phenomenal Maincrop and Late Metropole take about six to seven months from sowing the seed until ready for use.

The ground should be well prepared and a good supply of farmyard manure dug in about a month before transplanting. Transplant into rows about 2 feet to 2 ft. 6 in. apart and 2 feet between the plants in the rows. Keep them well watered, and when the plants are well established give the bed a dressing of market garden manure at the rate of 3 oz. per square yard and water it in. After watering, Dutch hoe the bed as soon as it is dry enough to do so. The secret of success in cabbage and cauliflower growing is to keep the plants well watered and hoed during the late summer months.

If the cucumbers, melons, and pumpkins are not setting freely, pinch back the runners. This usually encourages them to set better.

Make a last sowing of French beans, and thin out the carrots, parsnips, and red beet that were sown last month. The plants thinned out may be transplanted with a reasonable chance of success.

Viticultural Notes

By D. G. Quinn, Viticulturist

Climatic conditions this year have been unusually dry. While such conditions are appreciated in the irrigated areas, physiological disorders, such as sunscorch, early leaf fall and premature ripening are threatening to develop seriously in the non-irrigated vineyard areas, and although no remedies can be recommended, these troubles are briefly reviewed.

Table grapes are more susceptible to sunburn than wine or drying sorts. The Flame Tokay, which is very popular on American markets, cannot be grown in Victoria, because it loses its crop through sunscald about Christmas time practically every year. Sunburn is occasionally noted on other varieties, particularly after a heavy sulphuring or the sudden exposure of formerly shaded bunches, but the main cause of sunburn is drought.

Insufficient moisture also causes the loss of many basal leaves and the premature ripening of that fruit not shed through sunburn.

The influence of premature ripening on the final composition of the fruit is of interest particularly to wine makers, and may be explained as follows:—

The fruit passes through three distinct stages of development, viz., the herbaceous, the ripening, and the over-ripening stage. During the first stage the berry functions like other green parts of the plant. In the second stage the chlorophyll and pectous matters disappear, the percentage of sugar rises quickly and the tartaric, citric, and malic acids are gradually oxidized, or neutralized by alkaline substances, mainly potash, in the sap.

When the seeds reach maturity the fruit stalk begins to dry up and the over-ripening stage sets in. The modifications which occur from then on are due mainly to evaporation and oxidation.

The rapidity through which these stages of development are passed is controlled mainly by climatic conditions, and this influences the quality and type of wine more than the factors, soil or variety. In seasons when the middle or ripening period is acutely shortened by drought, the composition of the fruit is somewhat abnormal, because the high percentage of sugar, shown by the hydrometer test, does not necessarily mean that the normal quantity of sugar has been elaborated during the ripening period, but rather that a premature start on the over-ripening stage has begun, before the acids found in green grapes have been converted to the form in which they should be found in ripe fruit, namely, acid and neutral salts. In other words, wines made from such fruit are apt to be harsh. This also explains why attractive light table wines cannot be produced in hot early ripening districts.

Another problem, which the present dry spell has caused in several localities, is the migration of locally-bred grasshoppers from the pasture paddocks to adjacent vineyards. Although these insects prefer almost any other green foliage to that of the vine, they have, this season, damaged several hundred acres of vineyard.

The liberal use of poison bait, spraying the top foliage and burning wide breaks in the pasture paddocks have done much good, but even so, this pest has proved very serious and difficult to combat in the vineyard, and should it persist, headlands of a poisonous plant like Larkspur might tend to check the migration of the hoppers from the pasture paddocks into the vineyard. However, in normal seasons this insect confines its attention to the summer growing weeds of the pasture paddocks, and climatic conditions seldom force it into the vineyard in serious numbers.

Prunes.

With the prune harvest approaching it is interesting to hear that "processed" prunes are now selling much more freely than ordinary prunes sold formerly. Such prunes are placed in a steam chamber before packing and so reach the housewife in a soft, pliable, attractive state. As it takes much less time nowadays to properly prepare this fruit for the table, the demand for the good prune is naturally increasing.

Attractive prunes can only be produced from well-ripened fruit of the right variety. The outstanding variety is the prune D'Agen. The pulp of this fruit is very rich in sugar, and much less acid than most other varieties. Furthermore, the stone is small, perfectly smooth, and separates cleanly and easily from the pulp.

Nothing curbs the public demand for prunes more than the appearance on the market of poorly developed samples of prunes of a tart, woody nature. The main cause of this trouble is the harvesting of the crop before it has reached the full-ripe stage, and as prunes do not ripen evenly on a tree no attempt should be made to harvest the whole crop at a single picking. Until the full-ripe stage has been reached the acidity of the fruit continues to diminish and sugar continues to accumulate. Early picking therefore gives rise to a tough, tart, unsavory product which does not respond to the packers' steaming process, and when placed on the market definitely depresses the demand for prunes generally.

The D'Agen prune is regarded as an outstanding variety.

Pamphlets on the subject of prune drying have been prepared by the Department of Agriculture, and are available for distribution, free of charge.

Fertilizers Act

Prosecution for Offence

At the Cheltenham Court of Petty Sessions on 19th January last, before Mr. O'Grady, P.M., and local justices, Messrs. D. M. Wallace and E. D. McBurnie, trading as the Growell Fertilizer Company, were charged with serious infringements of the Fertilizers Act. The defendants sold a parcel of Growell fertilizer, and in so doing violated sections 44 and 7 of the Act, because the fertilizer did not have a brand registered at the office of the Director of Agriculture and the labels attached to the bags containing the fertilizer did not comply with the requirements of section 7.

It was stated in evidence that it was impossible to blend the fertilizers used in the preparation of the fertilizer to obtain the very high percentage figures stated on the labels, and, in addition, the commercial value per ton of the fertilizer, calculated from the analysis by the unit value system, was £5 7s. 5d., whereas the guaranteed value was £14 4s. and the price charged £13 10s. per ton.

Defendants were convicted, and each one was fined £10 for the violation of section 44 and £1 for infringing section 7, with 13s. 6d. costs.

Efficiency of Pasteurization

The Phosphatase Test

By R. N. Trembath, B.Agr.Sc., Dairy Technologist, and F. S. J. Newman, B.Agr.Sc., Assistant Research Officer.

TO determine the efficiency of pasteurization of milk, Kay and Graham[1], at the National Institute for Research in Dairying, Reading, England, have devised a test which has become recognized as a definite control for commercial pasteurization. They have demonstrated that untreated milk always contains phosphatase, an enzyme capable of splitting phosphates. They have shown also, that, under certain conditions of time and temperature, this enzyme is destroyed by heat. They have also satisfied themselves that, under those conditions necessary for the destruction of the phosphatase enzyme, efficient pasteurization of milk is attained.[2]

The test which they have evolved depends upon the action of this milk enzyme on a compound of phenol and phosphorous—disodium phenyl phosphate—which it hydrolyses to produce free phenol. The phenol is then detected by Folin and Ciocalteau's phenol reagent, which gives a blue colour of an intensity depending upon the amount of phenol liberated. This colour is quantitatively estimated by reference to the Lovibond colour scale.

Kay and Graham found a definite correlation between the degree of heating of milk and the blue colour obtained in the test. The maximum colour produced from samples of milk carefully pasteurized by the batch method to legal requirements—that is, at 145°F. for 30 minutes—never exceeded 2.3 Lovibond blue units, and this colour standard has been adopted in the test as the upper limit for efficiency of heat treatment of milk.

To determine the suitability of the test under local conditions, it was necessary to verify the findings of Kay and Graham using the normal Melbourne milk supply. Milk was collected at various times over a period of two months to eliminate chance daily variations. These samples, twenty-seven in all, were batch pasteurized under carefully controlled laboratory conditions, and tested by the phosphatase method. The colour was compared with a standard glass of 2.3 Lovibond blue units—actual values could not be given as no tintometer was available. In all cases, the untreated milk gave an intense blue colour, estimated at between 15 to 20 blue units, and the same milks, treated as above, tested less than the 2.3 standard colour units.

Next the sensitivity of the test was determined. In assessing this, three factors were taken into consideration—namely—temperature, time held, and after-contamination with untreated milk. Samples were heated to temperatures ranging from 130°F. to 145°F. and held for 30 minutes. Others were heated to 145°F. and held for varying periods of time—from 10 to 30 minutes.

The results are summarized in Table I., in which the term "Positive" has been adopted for a colour greater than the standard 2.3 Lovibond blue units and negative for a colour less than the standard. These results demonstrate the extreme sensitivity of the test, and its application to the control of processing methods. They are similar to the published figures of Kay and Graham and Leibovitch.[3]

TABLE I.—LABORATORY PASTEURIZATION OF MILK.

Sample.	Temperature.	Time Held.	Result.
Milk	130° F.	30 minutes	Positive
Milk	140° F.	30 minutes	Positive
Milk	143° F.	30 minutes	Positive
Milk	145° F.	30 minutes	Negative
Milk	145° F.	20 minutes	Positive
Milk	145° F.	10 minutes	Positive
Boiled milk ..	..	..	Negative
Boiled milk + 1·0 per cent. untreated	..	..	Positive
Boiled milk + ·5 per cent. untreated ..	..	..	Positive
Boiled milk + ·2 per cent. untreated ..	..	..	Positive

It should be emphasized, however, that the test does not take into account any contamination after pasteurization save that of raw or imperfectly treated milk. It is definitely a biochemical test for time and temperature control, and cannot be regarded as direct evidence of freedom from bacteria, which may gain access in the operations subsequent to pasteurization—as cooling and bottling.

TABLE II.—EXAMINATION OF COMMERCIALLY PASTEURIZED MILKS.

Sample.	Source.	Stated Treatment.	Test.
3	Bottle ..	*Stassanized.. ..	Positive
9	Vat ..	145° F. for 30 minutes	Negative
10	Vat ..	145° F. for 30 minutes	Negative
11	Vat ..	145° F. for 30 minutes	Negative
12	Bottle ..	*Stassanized ..	Strong positive
13	From cooler	145° F. for 30 minutes	Negative
14	Bottle ..	145° F. for 30 minutes	Negative
15	Cooler ..	145° F. for 30 minutes	Negative
16	Cooler ..	145° F. for 30 minutes	Negative
17	Cooler ..	160° F., falling to 145° F. in 30 minutes ..	Negative
58–9	Stassanizer	*Stassanized, 170° F.	Negative
60–1	Stassanizer	*Stassanized, 166° F.	Standard (2·3)
62–3	Stassanizer	*Stassanized, 162° F.	Positive
64	Stassanizer	*Stassanized, 160° F.	Positive
67	Bottle ...	145° F. for 30 minutes	Negative
116	Cooler ..	145° F. for 30 minutes	Positive
117	Cooler ..	145° F. for 30 minutes	Positive
118	Cooler ..	145° F. for 30 minutes	Positive
119	Vat ..	145° F. for 30 minutes	Positive
120	Cooler ..	145° F. for 30 minutes	Strong positive
121	A.P.V ..	145° F. for 30 minutes	Strong positive
122	Vat ..	145° F. for 30 minutes	Weak positive
123	Cooler ..	145° F. for 30 minutes	Weak positive
155	Bottle ..	*Stassanized ..	Negative
156	Bottle ..	145° F. for 30 minutes	Positive
157	Vat ..	143° F. for 30 minutes	Strong positive
158	Can ..	143° F. for 30 minutes	Positive

* Short-time high temperature pasteurization. Time of heating, 18–20 seconds.

An attempt was made to apply the test further—to cream and butter made from pasteurized cream. It was found that heating cream and milk in exactly the same manner, to the same degree, and for the same time, that is, at 145 deg. Fahr. for thirty minutes, invariably resulted, upon application of the test, in the production of a blue colour from the cream greater than the 2.3 units standard, while the milk registered colours less than 2.3 units. Tests upon untreated cream were similar to those on raw milk. In each of twenty samples of cream was this result noted.

It is interesting to note that the batch method of pasteurizing cream at a temperature of 145°F. for 30 minutes has, for some time, been considered inefficient. High temperature, short-time pasteurization, or the "flash" method, was then tried out. Here, as far as the work was advanced, the results were unsatisfactory. The total destruction of the enzyme phosphatase occurs between 170°–175°F. This temperature would be satisfactory for milk pasteurization—including stassanization—if the destruction of the cream line at these temperatures did not limit the "flashing" of milk. Above 145°F., the cream line is noticeably reduced, consequently the batch or holding method is more favored in the trade. For cream pasteurization to be efficient, a temperature of at least 185°F. must be attained. At this temperature, the test has lost its sensitivity, and consequently its usefulness, as a negative result could indicate heating to any temperature from 170°F. upwards, leaving a substantial margin in which the cream is not effectively pasteurized. A positive test would indicate gross errors in pasteurization. Leibovitch[3] has also noted the loss of sensitivity of the test when applied to high temperature short-time pasteurization. The application to butter naturally depends on the above considerations.

Over the whole series of experiments, plate counts of the milks and creams used were carried out on lactose agar medium. In general, the counts varied in accord with the tests, but several erratic results reduced the usefulness of this portion of the work.

Summary.

1. The phosphatase test of Kay and Graham may be successfully applied to batch pasteurized milk in this city.

2. Its application to cream, both batch and flash pasteurization, is not so satisfactory.

3. No definite correlation with plate counts was obtained, the general agreement being upset by several erratic results.

References.

1. Kay and Graham. *Journal of Dairy Research* VI., 2, 191.

2. Hoy and Neave. *The Lancet*. CCXXXIII., 5949, 595.

3. Leibovitch. *Le Lait*. XVII., 165, 643.

Investigations on the Storage, Ripening, and Respiration of Pears

By G. B. Tindale, B.Agr.Sc., S. A. Trout, M.Sc., Ph.D., and F. E. Huelin, B.Sc., Ph.D.

The first portion of this report, which appeared in the January issue of this Journal, dealt with the Colour, Pressure and Chemical Composition of Pears at Picking; Length of Storage Life and Physiological Disorders of Cool Storage; The Effect of Temperature, Maturity and Size on Storage Life; Physical and Chemical Changes during Storage; Changes in Respiration; and the Relation between Temperature, Respiration and Length of Storage Life.

Ripening.

ALTHOUGH a pear may soften and colour in store, it cannot be assumed to have ripened normally, unless it has developed full flavour, is very soft, and running with juice. The ability of a pear to ripen depends on the length of time it has been in store and the storage temperature. It has already been stated that pears can be kept at non-ripening temperatures only for a certain length of time and ripened normally on removal to higher temperatures. Only brief reference, however, has been made to the optimum ripening temperature, i.e., the temperature at which colour, flavour, and juice are best developed. Tropical fruits usually require higher temperatures than temperate fruits for ripening.

It has been found that the early maturing varieties, like the W.B.C. which is usually picked in the summer months, require much higher temperatures for ripening, than the later maturing varieties, like the Winter Nelis, which is picked in the autumn.

Minimum ripening temperatures, giving fully satisfactory results have been determined for several varieties of pears, and are as follow :—

Variety.	*Satisfactory Minimum Ripening Temperatures.*
W.B.C.	60° F.
Howell	55° F.
Bosc	55° F.
Comice	45° F.
Anjou	45° F.
Packham	45° F.
Winter Cole	40° F.
Josephine	37° F.
Winter Nelis	37° F.

The W.B.C. will not ripen below a temperature of 55° F., developing core breakdown and scald without production of adequate juice and flavour. Ripening may occur at 55° F., however, but only in W.B.C. pears which have been in cool store at 32° F. for half the length of their storage life, i.e., six weeks, but the flavour of this fruit is not equal to that ripened at 65° F. Full colour, flavour, and juice are best developed at 65° to 70° F. Although these qualities have been produced at 60° and 75° F., in some years flavour has been lacking at the former temperature, and colour at the higher.

The Bosc has ripened at 45° F. after a short storage period, but later, a higher temperature is required for the development of the best qualities on ripening. The Packham and Josephine frequently ripen without changing colour, and in some years, a deeper colour has been developed at 50° F. than at 65° F. The Josephine and Winter Nelis pears ripen satisfactorily at 37° F., although better qualities are produced at higher temperatures. The optimum ripening temperature for each variety has not been accurately determined, but in general, it is approximately the mean of the minimum ripening temperature and 65° F.

The times for the various varieties to ripen and become overripe, stored at different temperatures immediately after picking, are recorded in Table XI. The time at which the fruit is ripe has been taken as the first time when the fruit is running with juice and full of flavour. Overripeness is the stage at which the fruit first develops a fermented or overripe flavour.

The relation between time to ripen and temperature is plotted in Fig. 26. In this it will be seen that a fall in temperature of 8° F. from 45° to 37° F. has a much greater effect in retarding ripening than a similar fall in temperature has between the range 45° to 65° F.

The times to ripen in Table XI. and Fig. 26 refer to fruits placed at the various temperatures immediately after picking. The time

to ripen at 65° F. for fruit stored at different temperatures for various periods of time has also been determined. Samples of W.B.C. pears were removed to 65° F. after various periods at 30°, 32°, 34°, and 36° F., and the time to ripen was recorded. The results were as follow :—

Temperature.	Storage Period. (Weeks.)	Days to Ripen at 65° F.
36° F.	0	8
	2	6
	4	5
	6	4
34° F.	0	8
	2	7
	4	6
	6	5
	8	5
32° F.	0	8
	2	7
	4	7
	6	6
	8	6
	10	5
	12	5
30° F.	0	8
	2	7
	4	7
	6	7
	8	6
	10	6
	12	5
	14	5

The time to ripen therefore depends on the treatment which the fruit has received prior to ripening.

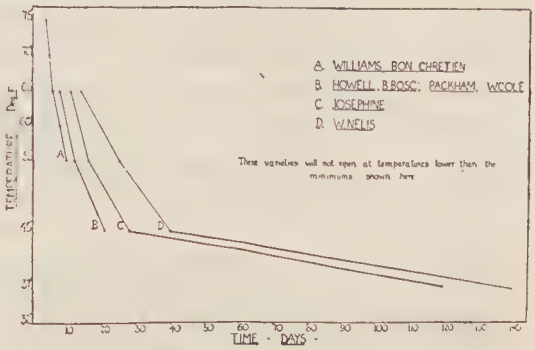
A. WILLIAMS, BON CHRETIEN
B. HOWELL, B.BOSC, PACKHAM, W.COLE
C. JOSEPHINE
D. W.NELIS
These varieties will not ripen at temperatures lower than the minimums shown here
TEMPERATURE
TIME - DAYS

Fig. 26.—Showing the relation between temperature and time to ripen various varieties of pears.

Disorders of Overripeness.

When pears removed from cool store before the end of their storage life are placed at ripening temperatures they develop full flavour, juice and aroma, remain in this condition for a short time, and then become overripe, i.e., very soft and mushy and fermented in flavour. When they are ripened after a short period in cool store the flesh becomes very soft and mushy in the overripe condition with a slight grey discolouration, and the skin is generally attacked by moulds. As the breakdown is not localized the condition suggests general and not core breakdown. Removed after longer periods of cool storage the pears develop scald or core breakdown in the overripe stage. Similar disorders are associated with overstorage, but with the important difference that overstored pears are devoid of flavour and juice, even when ripening is attempted. In

Table XI.—Days to Ripen and Become Overripe at Various Temperatures.

Variety.	Temperature.													
	75° F.		70° F.		65° F.		60° F.		55° F.		45° F.		37° F.	
	R.	OR.	R.	OR.	R.	OR.	R.	OR.	R.	OR.	R.	OR.	R.	OR.
	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.	Days.
W.B.C.	4	6	5	8	6	9	8	11	10	14	WNR.	WNR.	WNR.	WNR.
Howell	..	..	..	..	8	13	..	..	12	19	21	31	WNR.	WNR.
Bosc	..	..	..	..	8	13	..	..	12	19	21	31	WNR.	WNR.
Packham	..	..	..	..	8	13	..	..	12	19	21	31	WNR.	WNR.
Winter Cole	..	..	..	..	8	13	..	..	12	19	21	31	WNR.	WNR.
Comice	..	..	..	..	8	13	..	..	12	19	21	31	WNR.	WNR.
Anjou	..	..	..	..	8	13	..	..	12	19	21	31	WNR.	WNR.
Keiffer	..	..	..	..	8	13	..	..	12	19	21	31	WNR.	WNR.
Madame Cole	..	..	..	..	8	13	..	..	12	19	21	31	WNR.	WNR.
Josephine	..	..	..	..	11	16	..	..	16	24	28	38	120	141
Winter Nelis	..	..	..	..	14	22	..	..	25	33	40	50	140	168

R. = Ripe. OR. = Overripe. WNR. = Will not ripen.

overripe pears scald and breakdown occur subsequent to normal ripening, and in consequence the pear is very soft and full of juice.

The time at which the disorders of overripeness occur is dependent on the treatment which the fruit has received prior to ripening. This is indicated by the wastage recorded in Table XII., for W.B.C. pears removed after various periods at 32° and 37° F. to 65° F.

TABLE XII.—PERCENTAGE WASTAGE IN W.B.C. PEARS AT 65° F. AFTER VARIOUS PERIODS AT 32° AND 37° F.

Storage Temperature.	Storage Period.	Core Breakdown.
	(Weeks.)	
37° F.	4	8 % after 7 days at 65° F.
	5	40
	6	63
	7	100
32° F.	6	10
	8	20
	10	49
	12	86

PHYSICAL AND CHEMICAL CHANGES DURING RIPENING.

Rapid changes in colour, pressure, chemical composition, and respiratory activity occur in fruit which has been removed from cool storage to a higher ripening temperature. The rate at which these changes occur at a specified ripening temperature is dependent on the temperature at which the fruit has been previously stored and the length of storage period.

Changes in Colour and Pressure.—Measurements of colour and pressure were taken on W.B.C. pears on removal from 30°, 32°, 34°, and 36° to 65° F., and subsequently at daily intervals at this ripening temperature. The results are plotted in Figs. 27 to 30.

It will be seen that the number of days for full colour to develop at 65° F. gradually decreased as the storage period at each temperature increased. This was expected, as the colour was more advanced at each removal.

The pressure did not fall appreciably during storage, but fell rapidly during ripening, except when scald developed on removal, when there was no appreciable softening. The rate of fall of pressure during ripening was not constant, but was greatest in the early removals between the third and fourth day. With subsequent removals, the greatest fall occurred earlier, until in removals made just prior to the termination of storage life it occurred after the first day. An appreciable fall in pressure during the first day of ripening after removal from cool store indicates that the cool storage life has almost terminated.

Further experiments with other varieties under immediate and delayed storage conditions are necessary before this method of forecasting the termination of storage life can be recommended for commercial practice.

Change in Acid Content.—There was no evidence of any greater loss of acid during ripening than during storage. This is indicated in Table XIII. and Fig. 12.

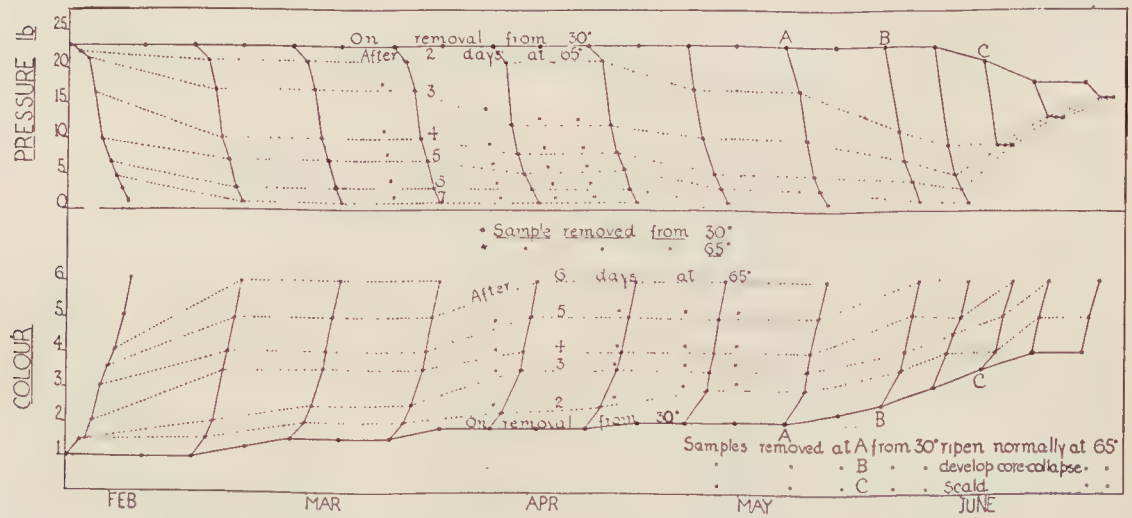

Fig. 27.—Showing changes in penetrometer pressure and colour of W.B.C. pears at 65° F. after various periods at 30° F.

TABLE XIII.—CHEMICAL CHANGES DURING COOL STORAGE AND RIPENING OF WILLIAM PEARS FROM DONCASTER. PICKED 20TH FEBRUARY, 1933.

Days at 34° F.	Days at 65° F.	Reducing Sugar.	Cane Sugar.	Total Sugar.	Acid.	Acetaldehyde.	Alcohol.
		%	%	%	%	%	%
2	0	7·36	0·58	7·94	0·178	0·0004	0·006
		7·92	0·72	8·64	0·184	..	..
		7·67	0·87	8·54	0·178	..	..
		7·32	0·46	7·78	0·178	..	..
35	0	8·12	0·52	8·64	0·163	0·0007	0·006
	2	7·98	1·06	9·04	0·153	..	..
	3	..	..	..	..	0·0016	0·029
	4	7·47	1·67	9·14	0·143	..	..
	6	7·12	1·86	8·98	0·15	0·0044	0·047
	7	..	..	..	..	0·0031	0·066
	8	7·08	1·72	8·8	0·161	0·0052	0·074
64	0	8·47	0·67	9·14	0·145	0·0014	0·012
	3	7·41	1·29	8·7	0·137	0·0042	0·037
	5	6·49	1·49	7·98	0·148	0·0079	0·115
	6	..	..	..	..	0·012	0·153
	7	6·66	1·22	7·88	0·126	0·0101	0·217
	8	..	..	..	..	0·0117	0·24
77	0	7·8	0·78	8·58	0·129	0·001	0·013
	2	7·37	1·11	8·48	0·123	0·0034	0·046
	4	7·17	1·37	8·54	0·137	0·0069	0·135
	6	6·99	1·21	8·2	0·125	0·0066	0·233
99	0	7·92	0·72	8·64	0·117	0·0033	0·074
	3	7·65	0·79	8·44	0·107	0·0045	0·162
	6	7·41	0·63	8·04	0·105	0·0031	0·273

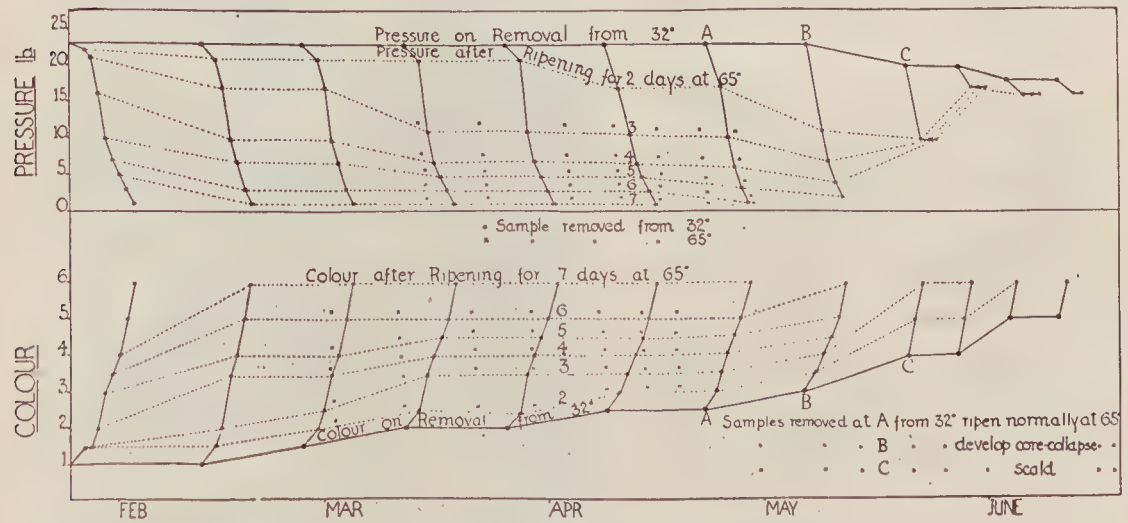

Fig. 28.—Showing changes in penetrometer pressure and colour of W.B.C. pears at 65° F. after various periods at 32° F.

Changes in Cane Sugar Content.—During ripening at 65° F., there was a considerable increase in cane sugar (Fig. 11), and the maximum concentration occurred just before the onset of breakdown. At the first removal to 65° F., normal ripening occurred, and the cane sugar content

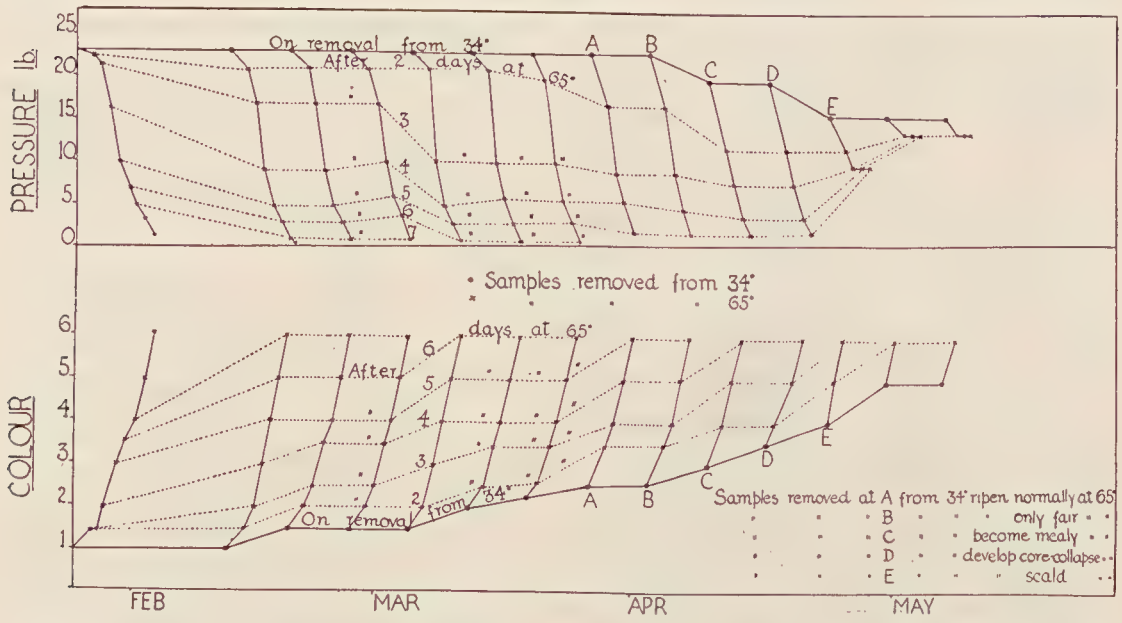

Fig. 29.—Changes in penetrometer pressure and colour of W.B.C. pears at 65° F. after various periods at 34° F.

rose to 1.8 per cent. before the pears became overripe. Subsequent removals were made when the storage life was over, and the increases in cane sugar were progressively less, before the onset of core breakdown. At the final removal, shortly before scald occurred, the pears failed to ripen, and the concentration of cane sugar was unchanged.

The increase of cane sugar is apparently associated with ripening, and is arrested when ripening is inhibited at low temperatures or through the pears being overstored. Kidd (9) has shown that in the apple, the climacteric rise of respiration is accompanied by an increase in the concentration of cane sugar. It appears that in W.B.C. pears, the respiratory rise is only accompanied by an increase of cane sugar at higher temperatures, at which ripening can occur.

Changes in Alcohol and Acetaldehyde Content.—During ripening, there was a considerable and continuous increase in the alcohol content, this being more pronounced when the storage life was over. At the first removal to 65° F., when normal ripening occurred, the alcohol content increased at the rate of 0.008 per cent. per day, and was about 0.06 per cent. when the pears were ripe. At the end of the life, the abnormal metabolism at 65° F. was accompanied by a much more rapid rise in alcohol content, which was about 0.03 per cent. per day, in the last removal. Core breakdown invariably developed when the concentration of alcohol reached 0.1 per cent. (Fig. 13).

It is apparent that the senescence of the fruit, both in cold storage and at 65° F., involves a progressive replacement of the normal oxidative metabolism by respiration of the anaerobic type. In the final removal to 65° F. the respiration was probably mainly anaerobic.

The changes in acetaldehyde content during cold storage and subsequent ripening (Fig. 14), confirmed this conclusion. Acetaldehyde is formed as an intermediate substance in respiration, being a product of partial oxidation. The rate of increase of acetaldehyde was greatest during the

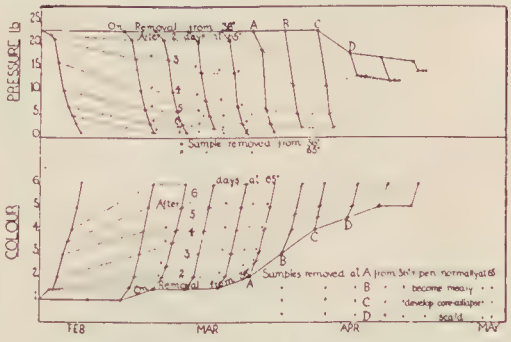

Fig. 30.—Showing changes in penetrometer pressure and colour of W.B.C. pears at 65° F. after various periods at 36° F.

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first abnormal ripening at 65° F. The concentration of acetaldehyde reached its maximum at the onset of core breakdown. A similar result has been obtained by Harley (4) in America. Apparently, the development of anaerobic metabolism is accompanied by a partial failure to oxidize acetaldehyde, which tends to accumulate.

At later removals, the increase of acetaldehyde was considerably reduced, and finally disappeared. At the final removal, when there is probably an almost complete failure of atmospheric oxidation, alcohol is practically the only product, and any acetaldehyde formed would be reduced to alcohol.

"Gas" Storage of Pears.

It has been shown that a longer storage life can be obtained at 32° F. than at higher temperatures. With the object of prolonging the life still further, the "gas" storage method of Kidd and West (6) was tried in 1937. The fruit was stored at 32° F. in gas-tight cabinets in which various artificial atmospheres were maintained. The atmospheres were mixtures of carbon dioxide, oxygen, and nitrogen, in various proportions, the composition of each mixture being as follows :—

Atmosphere.	Carbon Dioxide.	Oxygen.
	%	%
Air	0	21
1	5	16
2	7.5	13.5
3	10	11
4	5	10
5	5	5
6	10	5

Atmospheres 1 to 3 can be maintained simply by controlling the ventilation, as the fruit in respiration produces carbon dioxide and absorbs oxygen in approximately equal amounts. To maintain atmospheres 4 to 6, it is necessary to pass nitrogen into the cabinets occasionally in addition to ventilating.

The varieties used were W.B.C., Howell, Bosc, and Packham. The W.B.C. was obtained from Shepparton and the other varieties from Doncaster. With each variety, storage in atmosphere No. 1 increased the storage life by about 50 per cent. and the time to ripen at 65° F., was increased by two to three days. Similar results were obtained in atmospheres 2 to 4, except that Bosc and Packham pears stored in the presence of 10 per cent. of carbon dioxide, occasionally developed "brown heart" after ripening. Pears stored in atmospheres 5 and 6, which contain only 5 per cent. of oxygen, soon ripened to a poorer quality than those stored in the other atmospheres. The best results were obtained by storage in atmospheres 1 or 4, thus avoiding "brown heart" and other injury. The storage life for each variety is as follows :—

Variety.	Storage Life in Months, at 32° F., in—	
	Air.	Gas Storage (5 per cent. CO_2, 16 per cent. O_2).
	Months.	Months.
W.B.C.	3½	6
Howell	4	6
Bosc	4	6
Packham	5½	8

Injurious Effects of Carbon Dioxide.

Apart from the intentional use of gas storage, the respiration from a large mass of fruit in a ship's hold may bring about the accumulation of carbon dioxide in the absence of adequate ventilation. Kidd and West (7) found "brown heart," such as sometimes occurred in Australian apple shipments, could be produced when the concentration of carbon dioxide was allowed to rise above 10 per cent., and it is particularly desirable to know what concentration is injurious in the storage and transport of pears.

In 1937, seven varieties of pears were stored at 34° F. in atmospheres containing 5, 10, 15, and 25 per cent. of carbon dioxide, maintained entirely by reduced ventilation. After a period of eight weeks (sufficient for overseas transport) the pears were ripened at 65° F. and examined with the following result :—

Variety.	Number in Sample.	Pears with "Brown Heart" in.			
		5 per cent. CO_2.	10 per cent. CO_2.	15 per cent. CO_2.	25 per cent. CO_2.
W.B.C. ..	24	0	0	0	..
Howell ..	18	0	0	0	2
Bosc ..	20	0	0	5	16
Packham ..	15	0	0	3	3
Josephine ..	15	0	0	5	8
Winter Cole	18	0	1	3	4
Winter Nelis	13	0	0	0	0

The term "brown heart" is used provisionally for any internal discolouration caused by excessive carbon dioxide.

The injury in Bosc, Packham, and Josephine pears was indicated before ripening by light brown patches in the core. After ripening, the core, and sometimes the surrounding region, became discoloured with extensive cavities. In the Bosc variety, the lesions were practically identical with core breakdown resulting from over-storage (see photograph of core breakdown). "Brown heart," in the Winter Cole pears, developed on ripening, and consisted of dark areas in the flesh without cavities. The Howell pears developed similar lesions, but only in an excessive concentration of carbon dioxide. Pears free from "brown heart," ripened satisfactorily after exposure to concentrations of carbon dioxide up to 15 per cent., but a fermented taste usually resulted when the carbon dioxide was allowed to accumulate to 25 per cent.

Generally, injury from "brown heart" first made its appearance when the concentration of carbon dioxide reached 10 per cent. The results suggest that the carbon dioxide should not rise above 5 per cent., as this concentration has given about the maximum increase in storage life.

Development of Core Breakdown.

Barker and Furlong (2) have found, with W.B.C. and Bosc pears, that core breakdown develops earlier in the inner layers of fruit ripened in the box than in the outer layers against the wood, and that unpacking before ripening delays its development. Experiments have been carried out with W.B.C. pears to test whether this finding applies to pears stored in the flat case, generally used for Victorian pears, or in the standard pear case of dimensions, 18½ in. x 11½ in. x 8½ in.

Pears were stored in both types of cases at 32° and 37° F., and two cases of each lot were removed at intervals from both temperatures to 65° F. The pears of one case were separated into inner and outer, and ripened in trays, while the pears in the second case were ripened in the case and separated into inner and outer lots after ripening. For ripening, the pears were placed in an insulated room, into which a fairly rapid current of air, at 65° F., was continuously passed. No difference in temperature was observed between pears in the trays and in the cases. All samples were wrapped. The results obtained are shown in Table XIV.

TABLE XIV.—PERCENTAGE CORE BREAKDOWN IN W.B.C. PEARS IN THE STANDARD CASE.

Treatment.	Separated before Ripening into—		Separated after Ripening into—	
	Inner.	Outer.	Inner.	Outer.
4 weeks at 37° F. and 7 days at 65° F. ..	8	0	42	30
5	40	42	78	52
6	63	49	100	100
6 weeks at 32° F. and 12 days at 65° F. ..	10	10	10	4
8	8	20	17	10
10	58	49	70	64
12	80	86	98	90

PERCENTAGE CORE BREAKDOWN IN W.B.C. PEARS IN THE FLAT CASE.

Treatment.	Separated before Ripening into—		Separated after Ripening into—	
	Inner.	Outer.	Inner.	Outer.
4 weeks at 37° F. and 7 days at 65° F. ..	5	3	14	25
5	28	28	22	25
6	70	90	70	90
6 weeks at 32° F. and 12 days at 65° F. ..	12	10	0	3
8	12	9	6	5
10	52	73	66	55
12	80	67	98	90

These data have been analysed statistically as the results of a "completely confounded" experiment. The results of this analysis are given below.

1. ANALYSIS OF THE WHOLE OF THE 37° F. DATA.

——	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ log e.
Between times of removal	2	16,285·75	8,142·875	2·1997
Between fruit ripened in cases and trays ..	1	2,053·5	2,053·5	1·5109
Between standard and flat cases	1	748·167	748·167	1·0062
Between inner and outer fruits	1	1·50	1·50	−1·5999
Interactions plus error	18	3,601·583	200·088	0·3466
Total ..	23	22,690·5		

Comparisons.	Z.	5 per cent. Point.	1 per cent. Point.
Between times of removal ..	1·8431	0·6341	0·8970
Between fruit ripened in cases and fruit ripened in trays ..	1·1643	0·7424	1·0572
Between standard and flat cases	0·6596	0·7424	1·0572
Between inner and outer fruits	1·9465	2·75	4·36

Thus there is significantly more core breakdown in fruit ripened in cases than in that ripened in trays. The differences between standard and flat cases and between inner and outer fruits are not significant in these data.

2. Analysis of Data for Fruit Stored at 37° F. and Ripened in Cases.

——	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ log e.
Between times of removal	2	8,320·500	4,160·250	1·8646
Between standard and flat cases	1	2,028·000	2,028·000	1·5047
Between inner and outer fruits	1	1·333	1·333	−2·1587
Interactions plus error	7	1,040·167	148·595	0·1980
Total ..	11	11,390·000		

Comparisons.	Z.	5 per cent. Point.	1 per cent. Point.
Between times of removal ..	1·6666	0·7777	1·1281
Between standard and flat cases	1·3067	0·8603	1·2526
Between inner and outer fruits	2·3567	2·73	4.34

There is, therefore, in this instance, significantly greater core breakdown in the standard cases than in the flat cases.

3. Analysis of Data for Fruit Stored at 32° F. and Ripened in Cases.

——	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ log e.
Between times of removal	3	22,621·25	7,540·4167	3·3127
Between standard and flat cases	1	100·00	100·00	1·1513
Between inner and outer fruits	1	121·00	121·00	1·2466
Interactions plus error	10	105·50	10·550	0·0268
Total ..	15	22,947·75		

Comparisons.	Z.	5 per cent. Point.	1 per cent. Point.
Between times of removal ..	3·2859	0·6553	0·9399
Between standard and flat case	1·1245	0·8012	1·1535
Between inner and outer fruits	1·2198	0·8012	1·1535

The differences between types of case and between inner and outer fruits are here significant.

4. Analysis of Data for Flat Case Only.

Regarding storage at different temperatures for different times as different "treatments" we have :—

——	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ log e.
Between "treatments"	6	28,557·000	4,759·500	3·0826
Between fruit ripened in trays and in cases	1	32·1429	32·1429	0·5838
Between inner and outer fruit ..	1	51·5714	51·5715	0·8203
Interactions plus error	19	1,592·1428	83·7970	1·0626
Total ..	27	30,232·8571		

The only significant difference is that due to "treatments."

5.—Analysis of Data for Fruit Ripened in Standard Cases.

——	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ log e.
Between treatments ..	6	16,352·7143	2,725·4524	2·8039
Between inner and outer fruit ..	1	301·7857	301·7857	1·7035
Interactions plus error	6	200·7143	33·4524	0·6373
Total ..	13	16,855·2143	..	..

Comparisons.	Z.	5 per cent. Point.	1 per cent. Point.
Between treatments	2·1666	0·6761	1·0680
Between inner and outer fruits ..	1·0662	0·8948	1·3193

From these analyses the following conclusions seem to be justified :—

1. There is no significant difference in core breakdown between fruit ripened in flat cases and fruit ripened in trays.
2. There is more core breakdown in fruit ripened in standard cases than in that ripened in flat cases or in trays.
3. There is evidence of greater core breakdown in inner fruit than in outer fruit, with pears ripened in standard cases.

These results are in agreement with those obtained by Barker and Furlong. These investigators also found that there was less core breakdown in fruit ripened in desiccators over which a fast air stream was drawn, and suggested that the influence of the box was probably due to the accumulation of a volatile product of the

fruit. In the experiments just described in which ripening took place in a fast air stream there was little likelihood of volatile products accumulating in the flat case where each layer of fruit consisted of two outer pears and one inner. There was a greater possibility of volatile products accumulating in the standard case where each layer of fruit contained four inner pears for two outer. If fruit should be conditioned in cases it would be advisable, especially if the standard case be used, for the retailer to dispose of the inner pears first.

Conditioning of Pears.

In Australia, and other countries, it is the usual practice to place bananas, which are harvested green like pears, in specially constructed rooms having precise temperature control for conditioning or ripening before sale. A considerable amount of attention has been given in Australia and England to the possibility of improving the quality of pears by conditioning them prior to marketing. The properly ripened pear is sweet, of excellent flavour and running with juice, but it is only on rare occasions that the public is able to purchase such a high-class article. It has been shown that the W.B.C. pear will ripen satisfactorily only within a temperature range of 60° to 70° F., and the Bosc pears at slightly lower temperatures. The longer keeping varieties will ripen satisfactorily at 45° F., but take at least three weeks to ripen at this temperature, compared with one week at 65° F.

Conditioning of pears is perhaps not essential in Australia, except during the winter months in Victoria and Tasmania, where the average temperature at this time of the year rarely exceeds 50° F. But in England the prevailing warehouse temperature at the time of the arrival of W.B.C. pears is approximately 45° F., and as the W.B.C. pear will not ripen at this temperature conditioning is essential if the public is to receive fully ripe and juicy fruit. It is not practicable to leave the pear in a ripening room until it is fully ripe and juicy, because its marketable life would then be too short. Investigations have therefore been conducted in Melbourne, to determine the treatment necessary to initiate ripening and enable it to proceed subsequently at 45° F.

It has been found that after a period of conditioning of two to three days at 65° F. the W.B.C. pear will ripen subsequently at 45° F. with the development of good flavour and juice, but the quality obtained at 45° F. after conditioning is slightly inferior to that obtained by keeping the fruit continuously at 65° F. A conditioning temperature of 65° F. gave better results than either higher or lower temperatures. Ripening was much more rapid at 75° F. than at 65° F., and in consequence the fruit did not hold its condition as well when subsequently held at 45° F. Conditioning at temperatures lower than 60° F. resulted in abnormal ripening.

Although a conditioning period longer than two to three days gave a fruit of better quality, the skin of such fruit was extremely sensitive to injury and developed brown marks even when handled with the greatest care. As hard immature fruit can be handled without risk of skin bruising, conditioning should be carried out if possible just prior to the sale of the fruit to the consumer. It has been shown, however, that W.B.C. pears held for one week at 45° F. before conditioning did not develop as good quality as those conditioned immediately after removal from store, and if held for a week at 50° F. ripened abnormally subsequently at 65° F.

It is essential, therefore, that W.B.C. pears should be conditioned as soon as possible after arrival in England, but this would only be practicable if the pears were sold to the London public only.

W.B.C. pears were given various conditioning treatments after six and eight weeks respectively at 32° F., and the time to ripen and to develop core breakdown subsequently at 45° F. are recorded in Table XIV.

TABLE XIV.—THE EFFECT OF CONDITIONING ON THE TIME FOR W.B.C. PEARS TO RIPEN AND DEVELOP 10 PER CENT. CORE BREAKDOWN.

Removed from 32° F. after Six Weeks.

Treatment.	Days to Ripen.	Time to develop 10 per cent. Core Breakdown at 45° F.
65° F. throughout ..	6	10 days
2 days at 65° F. then to 45° F. ..	12	16 ,,
3 ,, ,, ..	10	14 ,,
4 ,, ,, ..	6	9 ,,
45° F. throughout ..	FTR.	50 per cent. scald after 21 days

Removed from 32° F. after Eight Weeks.

Treatment.	Days to Ripen.	Time to Develop 10 per cent. Core Breakdown.
65° F. throughout ..	5	8 days
2 days at 65° F. then to 45° F. ..	11	15 ,,
3 ,, ,, ..	9	13 ,,
4 ,, ,, ..	5	8 ,,
45° F. throughout ..	FTR.	50 per cent. scald after 18 days

FTR. = Failed to ripen.

Although conditioning in England has been shown to be essential for W.B.C. pears, which are not likely to be extensively exported in the near future, it would improve the quality of the Bosc variety and hasten the ripening of other varieties arriving before the middle of May, for the English warehouse temperatures are approximately as follow :—

February.	March.	April.	May.	June.
45° F.	46° F.	52° F.	58° F.	63° F.

Canning of Pears.

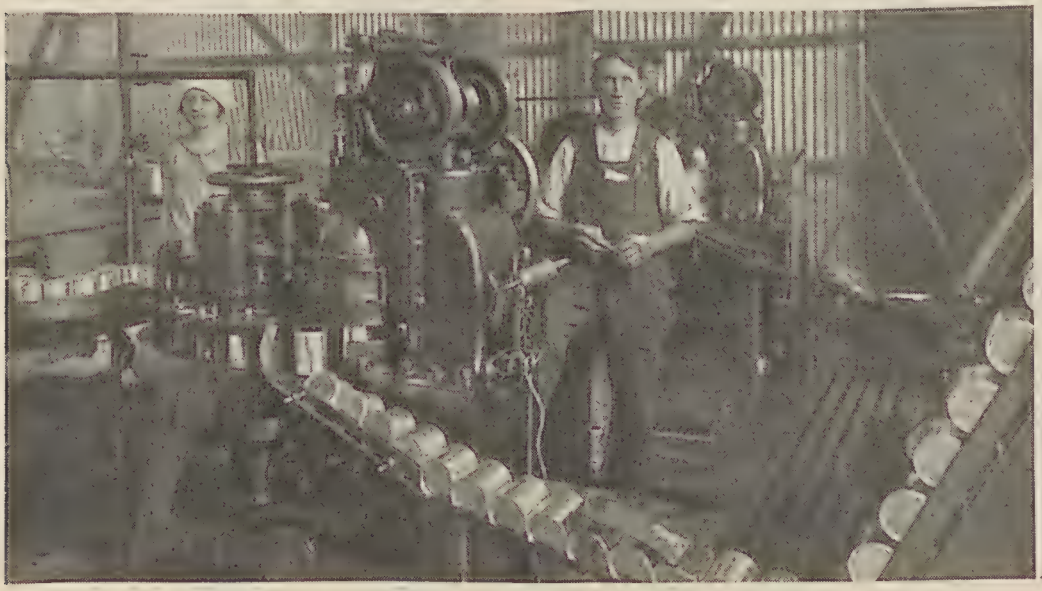
The canning of W.B.C. pears has become a very large industry in Victoria, and both cool storage and conditioning are of the greatest importance to the industry. In order that the cannery can produce an article of uniformly high quality, a supply of prime ripe pears should be available over a fairly long period. Without cool storage this would not be possible, and the canning season would be restricted to a few weeks.

In addition to extending the canning season, cool storage offers other advantages to the canner and grower. If the W.B.C. pear is allowed to ripen on the tree it frequently fails to develop the quality that is attained after cool storage and controlled ripening at 65° F. Pears ripened on the tree during the height of summer, when the shade temperatures are frequently in the range from 90° to 100° F., are mealy and thus of poor canning quality. Moreover, the ripe W.B.C. pear is a most delicate fruit, easily bruised and marked on gentle handling, but a green pear can be handled without any risk of injury.

Picking the fruit green enables the grower to pick over a period of two weeks, but if picked ripe it is doubtful whether labour would be available to handle the pears quickly enough to prevent them becoming overripe and wasty. Moreover, pears picked green and cool stored ripen uniformly on removal, but this is not possible when they are picked in all stages of ripeness. Picking in this way also avoids the risk of total loss through the pears being blown down from the trees during a storm, for pears fall very easily.

On delivery to the cannery the pears are immediately stored at 32° F. and held at this temperature until required for canning. It is essential that the pears should be removed from store within twelve weeks, as they will not ripen normally if stored beyond this period.

At the moment most canneries rely on atmospheric conditions for ripening, but some are now taking steps to control the ripening temperatures. Late in the season atmospheric conditions are sometimes too low for satisfactory ripening to proceed. Under atmospheric conditions the time to ripen varies enormously according to the prevailing temperatures, but under controlled



The canning of pears is an important industry in Victoria.

conditions at 65° F. the time to ripen is fairly constant, being approximately six days. When the time to ripen is known the cannery is able to organize its work more efficiently and have on hand at any time its exact requirements.

Experimental Shipments of Pears.

Experimental shipments of pears were sent overseas during the years 1933 to 1937, through the courtesy of the Orient, P. and O., Blue Star, Ellerman and Bucknall, and Port Line Shipping Companies. Electrical resistance thermometers were placed in cases of pears in various positions in the ships' cargo spaces, in order to determine the temperature conditions which prevail during overseas transport. The fruit was examined in England by officers of the Food Investigation Board.

The maximum difference in temperature between different positions, observed in the 'tween deck spaces was generally about 2° F. in the steady state. This represents very reasonable temperature control for spaces of this type, but even under these conditions slight differences in the ripeness of W.B.C. pears in different positions in the space could be detected at discharge. In general, however, the differences observed were not of much commercial importance except where the bulk of the cargo was in a forward condition. There is evidence that the storage life of W.B.C. pears is rather less on shipboard than in land stores. This difference is probably due to the fact that the rate of cooling is slower in exported fruit than in fruit placed directly in store on land.

Both experimental and commercial shipments, however, seem to have proved that the W.B.C. pear can be carried successfully to England, provided certain conditions are observed prior to shipment and the temperature conditions during overseas carriage are closely controlled. Further studies on overseas transport are in progress.

Recommendations for Export.

Pears intended for export are required by regulation to comply with certain standards regarding freedom from blemish and disease, size, &c. In addition to these regulations other conditions should be observed. The pears should be picked at their optimum stage of maturity, for at this stage they combine long keeping qualities with good quality on ripening after removal from cool store. Pears picked at the optimum stage of maturity are still deep green in colour, but, in view of the fact that they are green from the time they are first formed until they are almost fully grown, a better guide than colour for picking is required.

As a result of picking trials extending over several seasons, it has been found that the simplest and perhaps the most accurate guide to picking is a picking date, picking to commence a week before and to finish a week after the stipulated time. This allows two or three pickings to be made from each tree, and if the largest fruits are picked first the smallest fruits will have gained considerably in size when the last picking is made.

The optimum picking date does not vary by more than one week from year to year, being early in some seasons and late in others. The optimum picking dates (average of several years) for some varieties in Victoria are :—

W.B.C.	First week in February.
Howell	Mid-February.
Packham	End of February.
Bosc	First week in March.
Winter Cole	Mid-March.
Josephine	Third week in March.
Winter Nelis	Last week in March.

It is most important to cool the pears as promptly as possible after picking. If some days elapse between picking and cooling, the pears will ripen, especially during warm weather, and the subsequent cool storage life is thereby considerably reduced. This cooling of the fruit prior to shipment is termed " pre-cooling," and prompt pre-cooling is undoubtedly one of the most important factors in aiding the development of the pear export trade from Victoria.

It is important to recognize that the cool storage life of pears depends not only on temperature, but also on variety. The storage life of the various varieties at 32° F. and 34° F. is :—

Variety.	Storage Life at 32° F. Months.	Storage Life at 34° F. Months.
W.B.C.	3	2½
Howell	3½	3
Bosc	3½	3
Comice	4	3½
Packham	4½	4
Anjou	4½	4
Madame Cole	4½	4
Winter Cole	5½	5
Josephine	5½	5
Winter Nelis	6	5½

While the longer storage life is obtained at 32° F., yet, from the export point of view, it is important to take into account the storage life obtained at 34° F., because temperature records taken in ships' cargo spaces show that it is impossible to maintain an entire space at 30° to 32° F., and many pears are carried at temperatures ranging up to 34° F.

Packing Export Pears at Shepparton.

For local storage, pears are held at 32° F., and the same temperature has been adopted for pre-cooling pears for export. While this temperature is recommended for chambers specially set apart for pre-cooling pears, it frequently happens that pears are pre-cooled to 32° F. alongside Jonathan apples intended for local storage. At this temperature the Jonathan is very subject to both scald and breakdown, and under such circumstances, it is advisable to pre-cool the pears to 34° instead of 32° F, in order to avoid much of the trouble usually experienced with Jonathan apples.

Pre-cooling to 34° F. instead of 32° F. would have little effect on pears shipped within a few weeks of pre-cooling, or on the long-keeping varieties like the Winter Cole, Josephine, and Winter Nelis, if these varieties were reserved for the last ships.

Pears must reach the overseas market before their storage life has terminated, for, although they may be of perfect appearance after this time, they will ripen abnormally either with poor flavour and juice or with the development of core breakdown and scald. In preparing a table for the last date for shipping, allowance has been made for at least six weeks for shipping the pears, and a marketing (wholesale and retail) period of three weeks overseas, and it has been assumed that more pears are carried at 34° F. approximately than at 32° F. Thus if nine weeks are deducted from the storage life at 34° F. for each variety, the latest date for shipping each variety is as follows :—

W.B.C.	..	Mid February.
Howell	..	First week in April.
Bosc	..	Mid-April.
Packham	..	First week in May.
Winter Cole	..	First week in June.
Josephine	..	Mid-June.
Winter Nelis		Mid-July.

The latest shipping date is marked on Figs 4 to 10, and it will be seen that, at this time the pear has reached a certain colour and pressure. In general the fall in pressure up till this time is 1 to 2 lb., but this is not sufficient for the use of a pressure tester to be advocated. As colour has given consistent results, it is advisable that the pears should not be exported if they are more yellow than Plate 2 on the chart.

By shipping the Howell and Bosc first, then the Packham and Cole, and finally the Josephine and Nelis, the market could be continuously supplied with pears arriving within the limits of their storage life, and hence ripening with that degree of lusciousness and flavour typical of the variety. There has been a tendency recently to spread the market further by forwarding on late ships, and the variation in storage life between the different varieties has been overlooked, with the result that some varieties have been shipped too late. A buyer purchasing a line of overstored pears, which no doubt are of perfect appearance

finds that instead of ripening with the usual excellent qualities it develops core breakdown or even scald, with no flavour or juice. The buyer, being a heavy loser, would condemn the variety, and probably avoid its purchase in future years. The same variety shipped a little earlier would have arrived within the limits of its storage life and would have ripened with its usual excellence.

Referring to the W.B.C. pear it will be seen that the storage life of this variety at 34° F. is so short that there is very little margin of safety for export. Even though it may arrive overseas within the limits of its storage life, there is still the problem of its ripening. At the time of its arrival in England the English warehouse temperature is approximately 45° F., which is far too low for the normal ripening of W.B.C. pears. Thus controlled ripening would be required, but a ripe W.B.C. is a most delicate fruit to handle, and the trade dislikes handling such an easily bruised fruit. Perhaps some retailers would attempt ripening, but few would instal equipment for such a minor business.

The other varieties have a much longer storage life, and will ripen at temperatures considerably lower than that required for the W.B.C. Moreover, as they are shipped later, they arrive in England when the temperatures are higher, and artificial methods for ripening are therefore not necessary. Thus, while there is an abundance of the later longer-keeping varieties, the export of the W.B.C. variety is not recommended.

The methods of packing, &c., do not come within the scope of this paper, but it can be pointed out that packing is best done after cooling. This not only permits of more rapid cooling, but packing cooled fruits also overcomes the shrinkage which would otherwise take place.

After packing, the pears should be returned to the cool chamber and promptly forwarded to the ship's side when required for shipment. The ideal method of transport is by means of an iced insulated truck, but sometimes where the journey is short an ordinary motor truck can be used, the fruit being covered by a tarpaulin. What really counts is the rise in temperature which occurs during transport of the fruit from the cool store to the ship's hold. Some rise is unavoidable, and any method of transport is satisfactory provided the flesh temperature at the time of loading into the ship's hold does not exceed 40° F.

The ship should carry the pears as close to 32° F. as possible. Temperatures lower than this are not recommended, owing to the risk of the fruit being frozen.

Storage of Other Varieties

There is a collection of over 30 varieties of pears at the Burnley Horticultural Gardens and, in order to determine whether any of these varieties was outstanding in ripening or keeping quality, samples were stored at 32° F. While a few compared favorably with the commercial varieties referred to in this paper, the great majority were inferior either in ripening or keeping quality. Apparently, over a period of many years, the superior qualities of the present commercial varieties have come to be recognized, and the others have gradually been eliminated. The number of export varieties has now been restricted, and as a result of these experiments there does not seem any reason why the varieties classed as "suitable for export" should be changed.

Summary.

The optimum picking time for the main varieties of pears has been determined.

Colour at the optimum picking time has been consistent, but pressure and chemical composition have been variable from year to year.

The date of the optimum picking time did not vary by more than one week from year to year, and picking to a definite time table is recommended.

Pears picked at the optimum stage of maturity combined relatively long storage life with good quality on ripening.

Most varieties of pears did not ripen at 32° F., but had to be removed to higher temperatures in order to develop good flavour and juice.

The maximum length of time fruit can be kept in cool store and still ripened normally on removal to higher temperatures is termed "the cool storage life." Pears left in cool store after the termination of storage life may still be free from blemish, but will develop the physiological disorders of mealiness, core breakdown and scald on removal to higher temperatures.

The length of storage life is a function of variety, temperature of storage, maturity at picking time, and the delay between picking and cooling.

The length of storage life at 32° F. of W.B.C. pears picked at the optimum stage of maturity was 3 months, Bosc 3½ months, Packham 4½ months, and Winter Nelis 6 months. The storage life of these varieties was from six to eight weeks less at 37° F.

Delaying the picking time and delaying the storage after picking reduced the subsequent length of storage life.

Changes in colour, pressure, chemical composition and respiration occurred during storage. The rate of change was dependent on the storage temperature.

At the termination of storage life at 32° F., most varieties had a trace of green colour, and the pressure had fallen four pounds.

The rate of respiration increased in store until it reached a maximum termed the "climacteric," and then decreased, until in some cases there was no liberation of carbon dioxide, i.e., death occurred. The death of the pear in store was characterized by the development of scald.

The length of storage life of all varieties except the Winter Nelis, which partially ripened at the low temperatures, was approximately three-fifths of the time that the fruit took to reach the climacteric and two-fifths of the time till the development of scald in store.

To be of marketable value pears should be removed from store a considerable time before disorders appear in store.

The minimum satisfactory ripening temperature for the main varieties of pears has been determined and was 60° F. for the W.B.C., 55° F. for the Bosc, 45° F. for the Packham, and 37° F. for the Winter Nelis and Josephine varieties. The time taken to ripen is a function of temperature, variety, and the conditions which prevail prior to ripening.

Temperature had a much greater effect in retarding the ripening of Josephine and Winter Nelis varieties over the range 45° to 37° F. than over the range 65° to 45° F.

Changes in colour, pressure, respiration and chemical composition occurred during ripening.

The fall of pressure during ripening may be of value in forecasting the termination of storage life, as the fall in pressure in the W.B.C. pear was greatest at 65° F. after the third day in the early removals from 32° F., and after the first day, in removals made just prior to the termination of storage life.

Normal ripening was accompanied by increases in cane sugar, alcohol, and acetaldehyde, but in abnormal ripening there was little change in cane sugar, and the alcohol increased more rapidly, reaching 0·1 per cent. at the onset of core breakdown.

It is essential that the Australian W.B.C. pear should be conditioned or ripened under artificial conditions in England, as the prevailing warehouse temperatures at the time of its arrival are too low for the normal ripening of this variety.

After a conditioning treatment of two to three days at 65° F., the W.B.C. pear ripened satisfactorily subsequently at 45° F.

For canning, W.B.C. pears should be picked green, cool stored and conditioned after removal from store if the prevailing atmospheric temperatures do not exceed 55° F.

There have been indications that there is greater wastage in the inner layers of W.B.C. pears than in the outer layers against the wood when the pears are ripened in the standard pear case, and development of wastage can be delayed by unpacking the case before ripening. There have been no significant differences in wastage between the inner and outer layer of pears in the flat case.

Storage at 32° F in an atmosphere containing 5 per cent. of carbon dioxide has prolonged the life of four varieties by about 50 per cent. Higher concentrations, which might cause "brown heart," are to be avoided.

Temperatures taken by electrical resistance thermometers placed in cases in different positions in ships' cargo spaces have indicated that a considerable time elapsed before even a pre-cooled cargo reached a steady temperature of 31° to 32° F., and the usual variation in temperature between different positions is approximately 2° F. in the steady state.

Certain conditions should be observed during the picking and handling of pears for export. It is most essential that pears should be picked in a hard green condition and pre-cooled as soon as possible after picking.

For the overseas transport of pears a temperature of 31° to 32° F. is recommended, and the temperature conditions in the cargo spaces should be as closely controlled as possible.

Acknowledgments.

The authors wish to acknowledge the Orient, P. and O., Blue Star, Port Line and Ellerman and Bucknall shipping companies, Messrs. S. J. Perry and Co. and the Southern Victorian Pear Co., for their assistance with the experimental shipments overseas, the British Food Investigation Board for many careful examinations of experimental consignments, Mr. E. Thiele, of Doncaster, who made available certain trees for the maturity experiments, and also Professor W. J. Young, Dr. J. R. Vickery, Messrs. F. M. Read and S. Fish members, and Mr. D. B. Adam, a former member of the Advisory Committee on Fruit Storage Investigations, for their valuable help and advice.

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Inspection of Fruit for Export

THE Victorian apple and pear export season to the United Kingdom will commence about the middle of February. Grade standards will be similar to those operating last season, although certain varieties of pears, viz., Beurre Capiaumont, Beurre Clairgeau, Beurre Diel, Broom Park, and Lemon Bergamot will probably be excluded from shipments to England.

Strict supervision will be exercised particularly with regard to colour requirements (Jonathans must be approximately one quarter red), russet and spray residue. Growers are warned NOT to remove spray residue with oil, oily cloth or sheepskin. Fruit treated in this way will not be passed for export.

Fruit will be inspected at country stations from which a minimum of 30,000 cases are despatched. Fruit from stations handling less than this number of cases, viz., Narre Warren, Officer, Beaconsfield, Tynong, Garfield, Nar-Nar-Goon, Bunyip, Amphitheatre, and Elmhurst will be examined at the ship's side.

Every case of apples must contain not less than 40 lb. of fruit. Slack packed cases will not contain this quantity. Packing material, such as corrugated strawboard, must be placed on the top and bottom of apple cases and on the top, bottom, and sides of all pear cases. Packers should reject every apple or pear having a blemish, otherwise the 10 per cent. margin allowed will be exceeded.

Illustrated pamphlets on packing of fruit for export are available, free on application to the Director, Department of Agriculture, Melbourne, C.2.

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IT is in the best interests of producers that animals intended for either export or local trade should arrive at their destination in the best possible condition. Much unnecessary knocking about takes place, especially when loading and unloading the animals, and even when being driven on the hoof. Although the damage may not be apparent in the live animal, it will show up plainly after slaughter. Most of the damage so inflicted is preventable.

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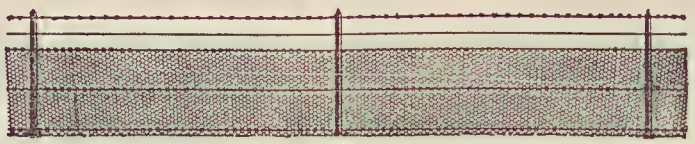

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No. 4. VICTORIA BELLMAN. (AA, C.R.) Born 28th February, 1937 *Price* 25 guineas
Sire: Chandpara Valentine (762 AA). *Dam:* Victoria Bell Rose (3511 AA). f.o.r. Werribee
Victoria Bell Rose produced 340 lb. butter-fat in 273 days as Jr. 4.

No. 5. VICTORIA EROS. (A, C.R.) Born 7th April, 1937 .. *Price* 15 guineas
Sire: Chandpara Valentine (762 AA). *Dam:* Victoria Flirt (3906 A). f.o.r. Werribee
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No. 6. VICTORIA LEADER. (A, C.R.) Born 11th August, 1937 .. *Price* 11 guineas
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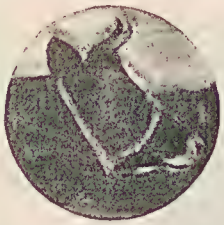

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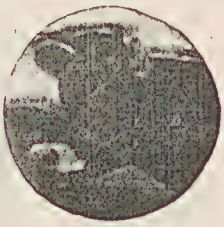

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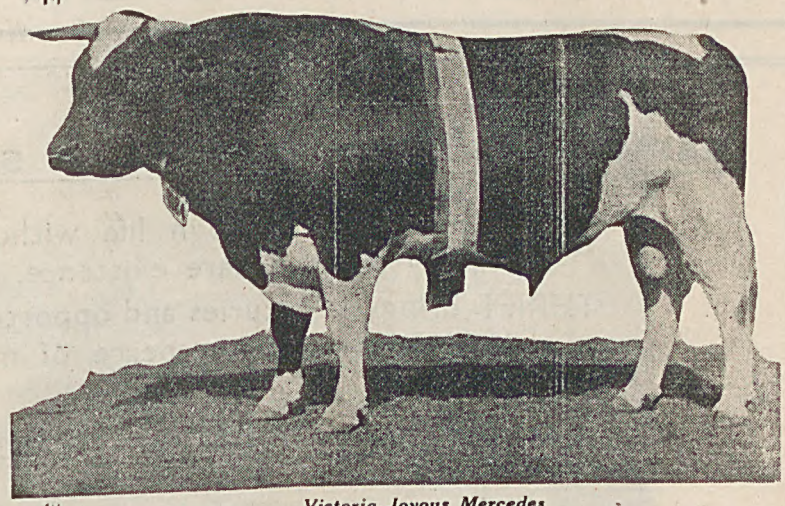

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Victoria Dancing Girl produced 319 lb. butter-fat in 273 days as Jr. 2. 4·03% test.
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3. **VICTORIA ILKA JO** (C.R.) *Born 23rd September, 1937*
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Victoria Ilkabelle produced 384 lb. butter-fat in 273 days as Sr. 2.
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4. **VICTORIA BARITONE** (C.R.) *Born 2nd December, 1937*
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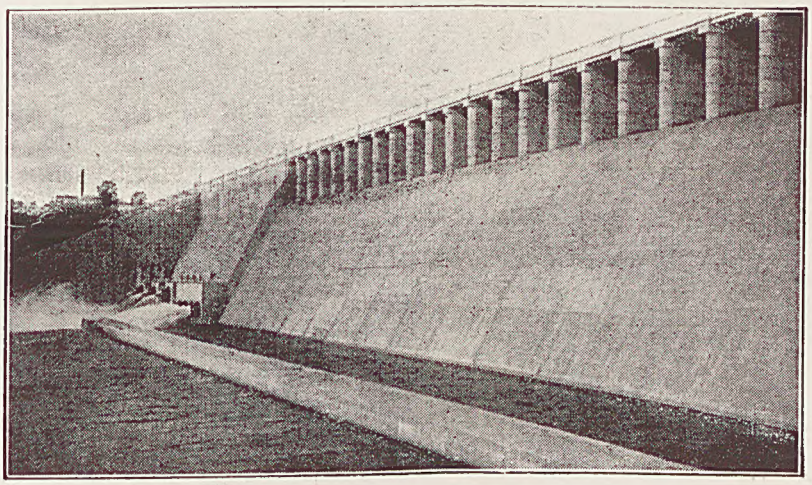

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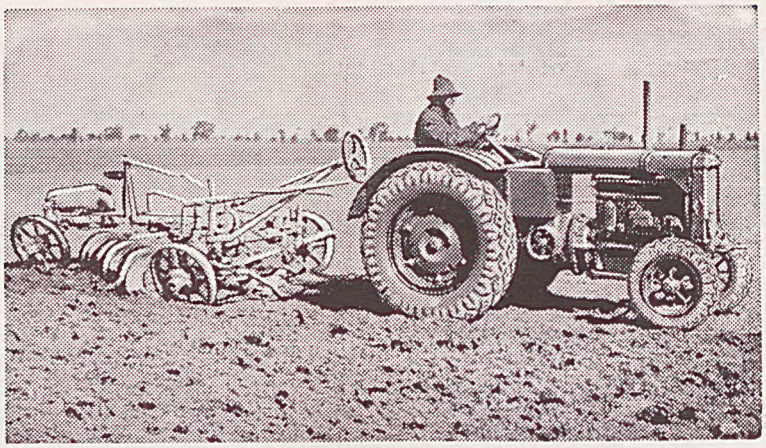
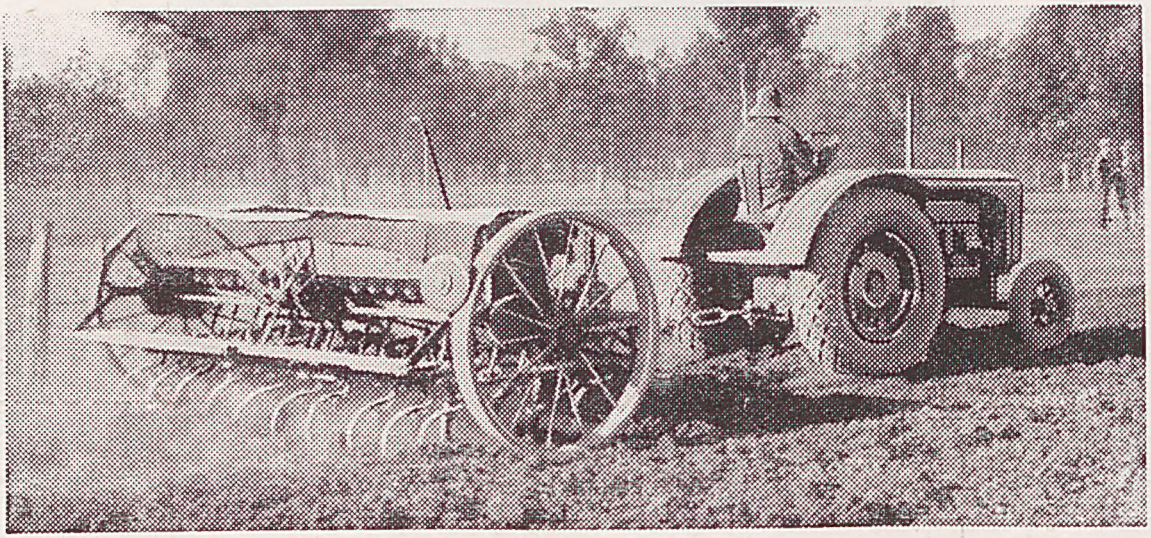


● Mr. F. M. Smith, of Oaklands, Riverina, driving his new Model "U," air-tyred, Allis-Chalmers. This tractor is seen pulling a 12-disc Gaston, with 6 ft. 6 in. width of cut, 3 in. deep, at 3½ miles an hour (second gear) in heavy chocolate loam and using 1¾ gallons of Kerosene an hour. It ploughs 2.9 acres an hour.



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